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ABSTRACT

This volume is the thirteenth in a series of 29 coordinated MINNEMAST units in mathematics and science for kindergarten and the primary grades. Intended for use by first-grade teachers, this unit guide provides a summary and overview of the unit, a list of materials needed, and descriptions of six groups of lessons. The purposes and procedures for each activity are discussed. Examples of questions and discussion topics are given, and in several cases ditto masters, stories for reading aloud, and other instructional materials are included in the book. This volume begins with a review of addition by joining sets and then introduces addition and subtraction on the number line. The use of the addition slide rule is introduced and problems for practice in addition and subtraction are provided. Properties of addition and subtraction are explored, and place value notation is introduced. (SD)

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Interpretations of ADDITION & SUBTRACTION

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THEMATICS AND SCIENCE TEACHING PROJECT

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4. USING OUR SENSES
5. INTRODUCING MEASUREMENT
6. NUMERATION
7. INTRODUCING SYMMETRY
8. OBSERVING PROPERTIES

FIRST GRADE

9. NUMBERS AND COUNTING
10. DESCRIBING LOCATIONS
11. INTRODUCING ADDITION AND SUBTRACTION
12. MEASUREMENT WITH REFERENCE UNITS
13. INTERPRETATIONS OF ADDITION AND SUBTRACTION
14. EXPLORING SYMMETRICAL PATTERNS

SECOND GRADE

15. INVESTIGATING SYSTEMS
16. NUMBERS AND MEASURING
17. INTRODUCING MULTIPLICATION AND DIVISION
18. SCALING AND REPRESENTATION
19. COMPARING CHANGES
20. USING LARGER NUMBERS
21. ANGLES AND SPACE
22. PARTS AND PIECES

THIRD GRADE

23. CONDITIONS AFFECTING LIFE
24. CHANGE AND CALCULATIONS
25. MULTIPLICATION AND MOTION
26. WHAT ARE THINGS MADE OF?
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UNIT 13

MINNESOTA MATHEMATICS AND SCIENCE TEACHING PROJECT

The Minnesota Mathematics and Science Teaching Project

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Third Printing
1971

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MINNESOTA MATHEMATICS AND SCIENCE TEACHING PROJECT

Director

DR. JAMES H. WERNTZ, JR.
Associate Professor of Physics
University of Minnesota

This unit, Interpretations of Addition and Subtraction, was developed by the MINNEMAST staff from earlier MINNEMAST materials, revised in the light of the experience of the many teachers who have tried the activities in the classroom. This trial edition, Unit 13 of the MINNEMAST Coordinated Mathematics-Science Series, was produced under the leadership of:

KAY W. BLAIR, Ph.D.
Mathematics Consultant

POLLY THOMSON EDMUNDS
Elementary Consultant

EDITH DAVIS
Editor

EDWARD R. LANDIN
Animal Illustrator

JUDITH NORMAN
Plant Illustrator

MINNEMAST
720 Washington Avenue S.E.
Minneapolis, Minnesota
55414

PRODUCTION STAFF

Copy: Eva Gray
Diane Johnson

Art: Charles Bjorklund
Sonia Forseth
Virginia Knight
Barbara Morris

Cover Design by Jack Kabat

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Complete List of Materials for Unit 13

(Numbers based on class size of 30.)

total number required to teach unit	item	lessons in which item is used
1	flannel board and various sets of objects (chalkboard may be used)	1,12,19
1	demonstration number line	3,5,7,8, 15,16,33
30	* plastic desk number lines, numbered 0 to 15 or higher	4,7,8,9,11, 14,16,Section 4
30	* sets of 15 small counters	4,14,Section 4
30	pencils	4
30	sheets of paper	4
1	box of colored chalk	5,15,19, 22,28
4	9-inch lengths of wood or cardboard (optional)	6
1	rectangular picture (mounted on cardboard)	6
1	roll of tape	6
30	* rulers from Unit 12, with inch and centimeter scales	6,20,Section 4
3-5	* lengths of string, yarn, paper, etc., to cut	16
30	*** sets of Minnebars	19,27,32
1	yardstick or tape measure with foot scale	20
30	boxes of crayons	20,Section 4
1	demonstration addition slide rule (made from demonstration number line tapes)	23,24,25, 26,32
30	*** addition slide rules	23,24,25, 26,Section 4

		Unit 13 (cont.)
2	**demonstration number line tapes (optional)	25
	paste	Section 4
30	scissors	Section 4
30	sheets of construction paper	Section 4
1	addition balance (see page 78)	Section 4
30	4" x 10" tagboard cards	Section 4
8	8" x 10" tagboard cards	Section 4
24	2" x 2" tagboard cards	Section 4
32	circular tagboard cards, 1" in diameter	Section 4
1	flannel board	27
8	objects for flannel board	27
10	sheets of construction paper to make paper sets	34, 35, 36, 38
3	*abacus kits	34, 35, 36, 38
10	3" x 5" cards	35
	play pennies and dimes (optional)	37

*kit items as well as

**printed materials available from
Minnemath Center, 720 Washington Ave. S.E., Mpls., Minn. 55455

***available from The Judy Company,
310 North Second Street, Minneapolis, Minnesota 55401

INTRODUCTION

SUMMARY OF CONTENTS

- Review of the set interpretation of addition and subtraction.
- An interpretation of addition and subtraction of the counting numbers on the number line.
- Introduction to an addition slide rule.
- Applications of addition and subtraction to situations familiar to children.
- Introduction to the addition and subtraction of two-digit numbers without "carrying" or "borrowing." (Optional)

BACKGROUND

This unit is an extension of Unit 11, Introducing Addition and Subtraction, and also draws on ideas developed in Unit 12, Measurement with Reference Units. In the introduction to Unit 11 we discussed both the set interpretation and the number line interpretation of addition and subtraction. Both interpretations will be used in this unit.

Addition is a mathematical operation that, following certain rules, associates with any two numbers (addends) a third number, their sum. This definition means little to a young child. He wants to know answers to questions such as these: What number do I get when I add 3 and 4? How can I find out for myself? Why do I need to add?

In the first grade we begin the study of addition by developing answers to such questions. Then the child is led to discover patterns and relations among addends and sums. From this beginning the child will gradually develop, throughout his elementary school years, a greater understanding of the properties of addition.

In this unit addition and subtraction on the number line are developed with counting numbers and, in some cases, with the numbers halfway between the counting numbers (e.g., $4\frac{1}{2}$). The number line interpretation of addition and subtraction can be used later for other fractions and other kinds of real numbers such as π and $\sqrt{5}$.

Subtraction, multiplication and division are other mathematical operations which can be approached in ways similar to that used for addition.

Topics are included which demonstrate that addition is commutative but subtraction is not; e.g., $4 + 3 = 3 + 4$ but $4 - 3 \neq 3 - 4$. It is not intended that a child become proficient at naming or verbalizing these properties, but rather that he develop assurance in applying them.

The unit ends with lessons planned to develop the conventional algorithms for adding and subtracting numbers with sums to 99 where no regrouping (i.e., carrying or borrowing) is needed. There is no intent to imply that all first graders will be able to develop this skill.

The emphasis of the MINNEMAST program is on the structure of mathematics and science. The skills of arithmetic are not ignored; they are expected to come with greater ease to those students who understand the basic concepts. When this unit is completed, some children will need the help of counters or the number line to find the simplest sums; other children will have memorized all sums of combinations of small integers; most children will probably be between these two groups in their abilities.

The addition and subtraction facts must be memorized in later grades before computations can be done easily, but each child must also have a method of finding any fact that he cannot recall. Mechanical aids (including the fingers) are perfectly acceptable. A child who can find $7 + 3$ easily by counting on his fingers or on a number line is well on his way to memorizing the fact that $7 + 3 = 10$. The frequent use of the combinations in problems and examples should allow the child to acquire many of them without conscious memorization.

NOTES ON THE TEACHING OF THIS UNIT

Unit 13, Interpretations of Addition and Subtraction may be started after Unit 12, Measurement with Reference Units is partly done, or you may choose to finish Unit 12 before starting Unit 13. If Unit 12 has been completed, Unit 13 may be taught alone or with Unit 14, Exploring Symmetrical Patterns.

It is expected that MINNEMAST materials will usually be taught two class periods each day. Generally a lesson should take one class period. The entire unit should take about six weeks if taught independently, or longer if taught in conjunction with another unit.

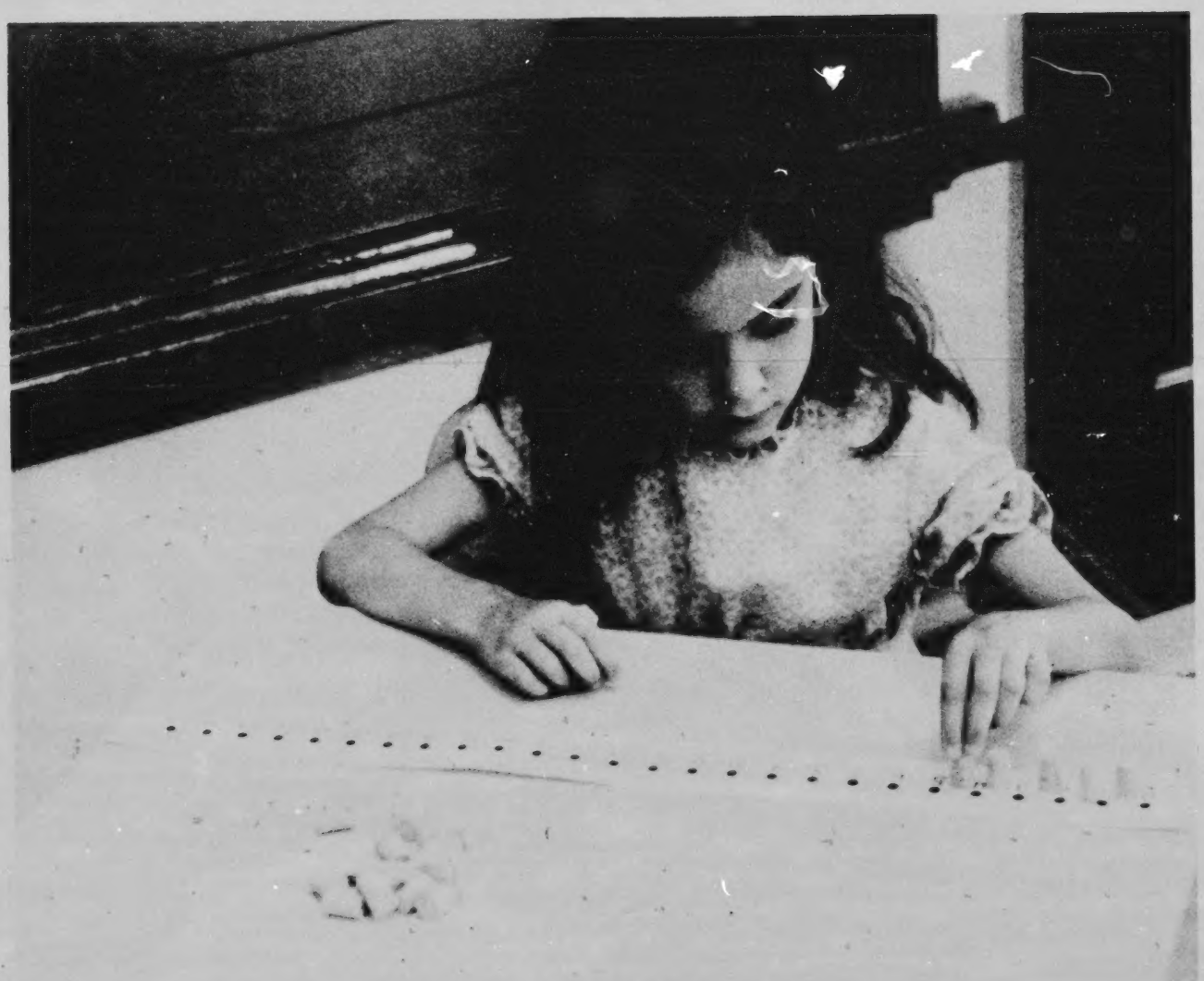
Each lesson has been planned for its contribution to the entire unit, but you should always be ready to make modifications to meet the particular needs of your class. Go quickly over things that the children understand, and insert additional problems or activities when necessary. Of course, questions and statements in capital letters are intended only as a guide. Feel free to put them into your own words.

The unit is divided into six sections, each of which emphasizes a particular topic. All but one of the sections are divided into lessons. Section 4 contains an assortment of activities providing reinforcement for the work presented in earlier sections.

The student manual contains the worksheets for this unit. The abilities of the children to use the worksheets independently will vary. See that a child receives all the help he needs to read and interpret a worksheet. He should be encouraged to use a number line or count on his fingers to find any number fact he has not already memorized. Starred problems are more difficult and are optional.

Some of the worksheets present problems from nature which serve as a source for new ideas and information. For example, a child might learn that potatoes grow underground and tomatoes grow above ground, or that a rhinoceros and a hippopotamus look quite different. The information contained in these problems should not be "taught," but children should be encouraged to examine and discuss the pictures.

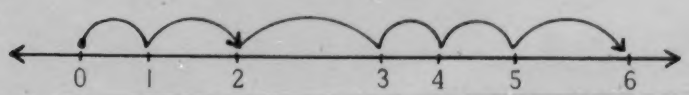
The nature pictures on the worksheets are intended to supply accurate illustrations of the animals and plants referred to, but they are not intended to provide the appropriate number of objects to be counted on the page.



SECTION 1 ADDITION ON THE NUMBER LINE

Unit 11, Introducing Addition and Subtraction, presented addition by combining sets of objects. It also introduced the number line. In this section we use both these ideas. We add first by joining sets of intervals on the number line, and then by making moves on the line.

In examples where the spaces on the number line are just being counted, the units do not need to be of the same size. For example, $2 + 4$ can be found by joining 2 spaces to the right of 0 with 4 more unit spaces to obtain 6 unit spaces. This can be shown by counting this way:



In examples where a certain number of unit spaces is associated with a length, the intervals must be the same length. This is true of the addition slide rule because lengths on the two scales must correspond. Even though a uniformly spaced number line is sometimes not essential, only uniformly marked lines will be presented to the children. But if your pupils draw non-uniform spacings, they should be accepted. Usually a sketch of a number line is just as useful for counting purposes as one carefully constructed with a ruler.

Lesson 1: REVIEW OF ADDITION BY JOINING SETS

The set interpretation of addition that was developed in Unit 11, Introducing Addition and Subtraction, is briefly reviewed here.

MATERIALS

- flannel board with various sets of objects (pictures may be drawn on a chalkboard in place of the flannel board and objects)
- Worksheet 1

PROCEDURE

Discuss problems similar to those given below with your class. For each problem use pictures on a flannel board or chalkboard to illustrate the joining of the sets. Have the children count the combined sets and write the addition equation on paper. Then ask for a volunteer to write the equation on the board.

Point out that each side of the equation is a name for the number of objects in the combined set.

If John had 5 apples and is given 3 more apples, how many does he then have? (5 + 3 = 8)

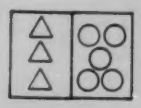
Alice ate 6 pieces of candy and then 2 more. How many pieces of candy did she eat? (6 + 2 = 8)

A set of 3 red pencils and a set of 4 green pencils are put into a box. How many pencils are put into the box? (3 + 4 = 7)

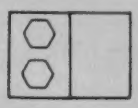
Have the children complete the equations on Worksheet 1. They are expected to count the pictures to find any sums they do not recall.

Worksheet 1
Unit 13 Name _____

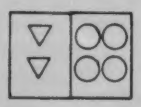
Finish the equations.



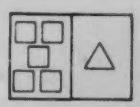
3 + 5 = 8



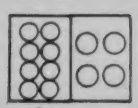
2 + 0 = 2



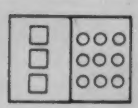
2 + 4 = 6



5 + 1 = 6

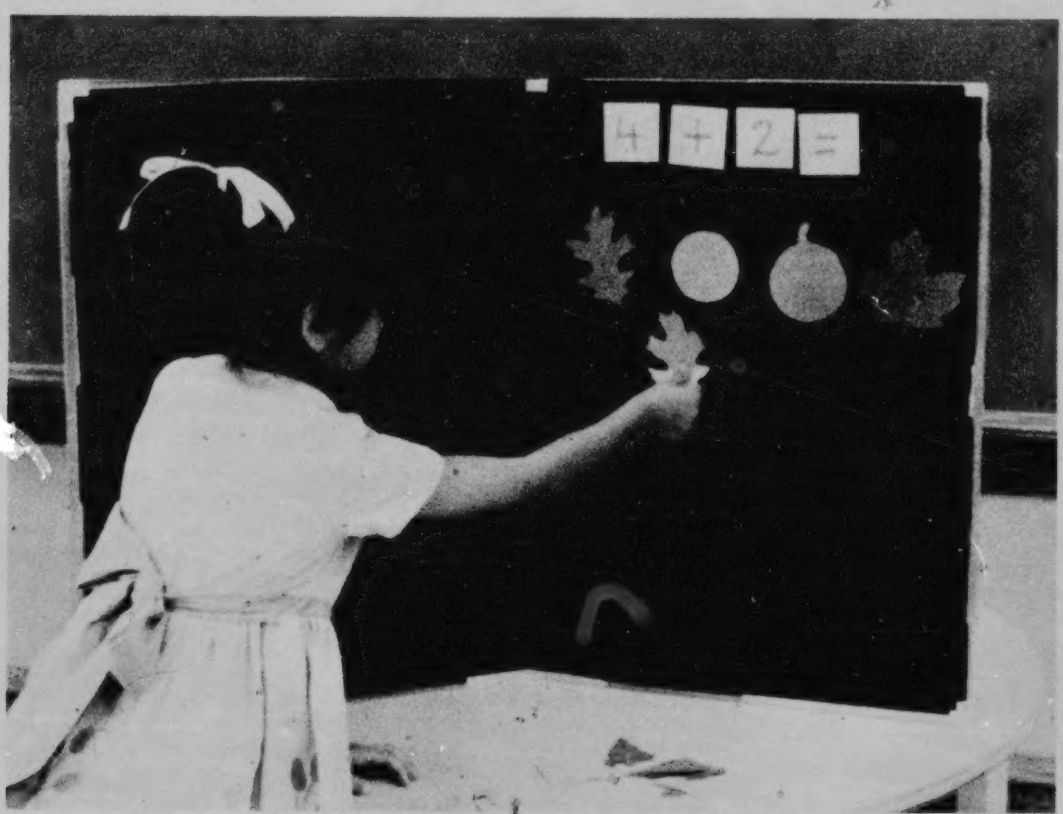


8 + 4 = 12



3 + 9 = 12

If a child has much trouble with the worksheet, he will need more review of the material in Unit 11 before proceeding.



Lesson 2: MAKING NUMBER LINES

In this lesson the children put numerals on segments of number lines. This reviews the concept of the number line and provides practice in writing numerals in sequence.

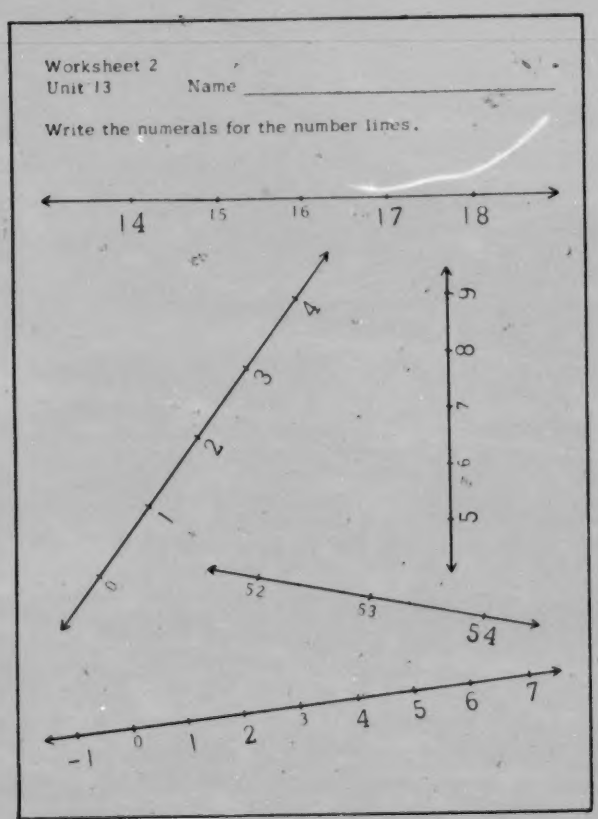
MATERIALS

— Worksheet 2

PROCEDURE

Tell the children that Worksheet 2 has some number lines with missing numerals. They are to fill in the missing numerals. Remind them that the line on the paper is only a part of the whole line (a line segment) and may not contain the zero point. The line segments are placed on the page in various positions.

One number line has a place for a numeral to the left of zero. This should be marked in red, as was done in Unit 11.



Success in this activity is necessary for success in the remainder of the unit. If some children have difficulty with Worksheet 2, give them additional activities of the same type before going on.

Lesson 3: MOVES ON NUMBER LINES

Displacements (moves) to the right and to the left on the number line were introduced in Unit II and are reviewed in this lesson.

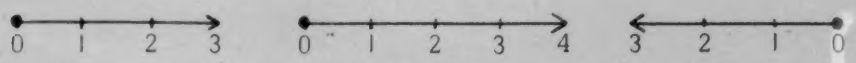
MATERIALS

— demonstration number line either drawn or mounted on the blackboard in such a way that arrows can be drawn over it

— Worksheets 3 and 4

PROCEDURE

A. Draw three arrows like these on the board:

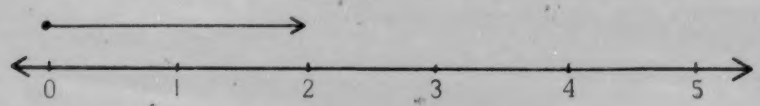


Explain that we want to give these arrows names that tell how long they are and whether they point right or left.

CAN SOMEONE NAME THE FIRST ARROW? (3 Right or Right 3.)

Suggest that a short way of writing this is 3R. Ask for suggestions for the other two arrows. (4R and 3L.)

B. Discuss the number line on the board with the children as a review of its introduction in Unit II. Draw a 2-unit arrow over the number line from 0 to 2.



I HAVE MADE A MOVE ON THE NUMBER LINE. THE ARROW SHOWS THIS MOVE. WHO CAN GIVE A NAME FOR THIS MOVE? (Right 2 units, 2 to the right, 2R, etc.)

NOW CAN SOMEONE DRAW AN ARROW SHOWING A MOVE THAT STARTS AT 5 AND MOVES 3 TO THE LEFT?

Also ask questions such as these:

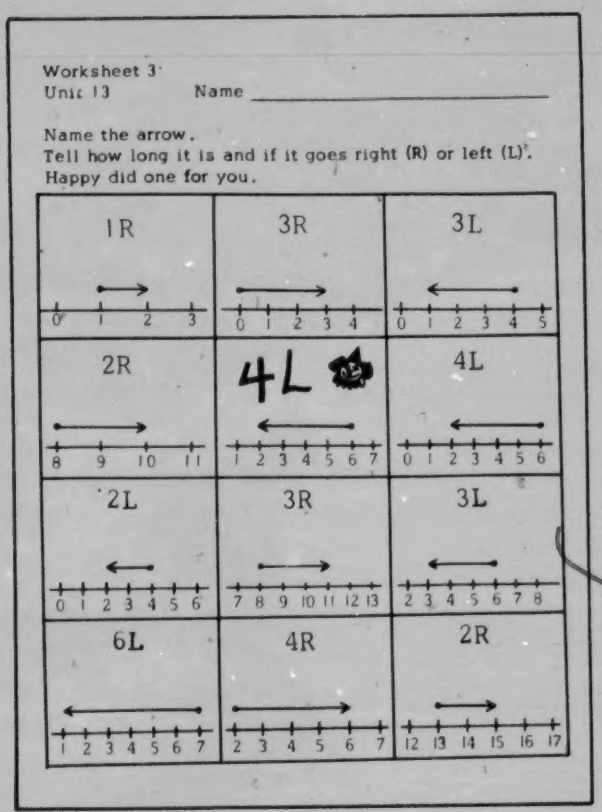
START AT 3, MOVE 2 LEFT. WHERE DO YOU END?

Repeat the activities of this part using various moves until you feel the children are ready for Worksheets 3 and 4.

C. Some children need to go through displacements physically to understand them. Here is one way to give them the experience:

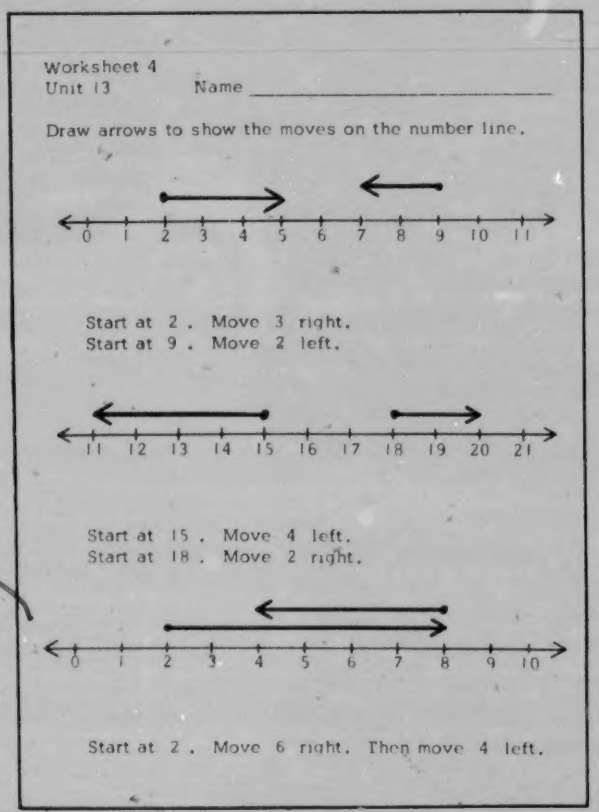
Have a large number line chalked or taped on the floor. Prepare several cards with directions such as "Walk 3R." A child stands on 0 (or any other agreed-upon point), draws a card, and walks through the move.

D. Certain board games such as "Chutes and Ladders" and pachisi also provide practice in moving specified numbers of spaces.


Worksheet 3
Unit 13 Name _____

Name the arrow.
Tell how long it is and if it goes right (R) or left (L).
Happy did one for you.

1R	3R	3L
2R	4L	4L
2L	3R	3L
6L	4R	2R


Worksheet 4
Unit 13 Name _____

Draw arrows to show the moves on the number line.

Start at 2. Move 3 right.
Start at 9. Move 2 left.

Start at 15. Move 4 left.
Start at 18. Move 2 right.

Start at 2. Move 6 right. Then move 4 left.

Lesson 4: COUNTERS ON THE NUMBER LINE

The purpose of this lesson is to lead the children from the idea of joining sets of objects to the idea of joining sets of unit spaces on the number line.

MATERIALS

-- for each child --

— 1 number line for his desk, 0 to 15 or more

— 15 or more counters small enough to fit on the number line spaces (it is desirable to have these in two colors)

— Worksheets 5 and 6

(For number lines you might use the tapes for the addition slide rule, dittoed paper strips, or printed number lines in an appropriate size.)

PROCEDURE

Each child should have on his desk a number line, 15 counters, pencil and paper. We will assume that counters are white and green, though of course they may be of any two colors. The 20-hole peg board with the sliding scale removed may also be used to demonstrate these problems.

A. Read the following problem to the class:

Ann had 7 pennies and Sam had 5 pennies. How many pennies did they have together?

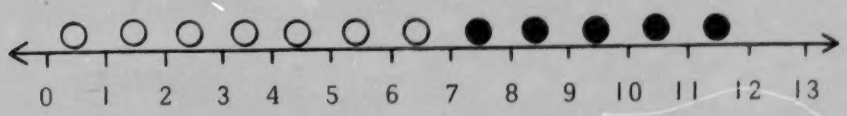
Guide the children's work rather closely for this first problem, as follows:

LET'S USE THE WHITE COUNTERS FOR ANN'S PENNIES. AS YOU COUNT THEM OUT, PUT THEM ON THE SPACES ON YOUR NUMBER LINE. START WITH THE FIRST SPACE BEYOND 0.

HOW MANY COUNTERS ARE THERE? (7)

HOW MANY SPACES ON THE NUMBER LINE HAVE COUNTERS ON THEM? (7)

LET SAM'S PENNIES BE SHOWN BY GREEN COUNTERS. AS YOU COUNT THEM OUT, PUT THEM ON THE NEXT SPACES ON THE NUMBER LINE.



HOW MANY GREEN COUNTERS DID YOU PUT DOWN? (5)

HOW MANY SPACES DID THEY TAKE? (5)

HOW CAN WE TELL HOW MANY COUNTERS THERE ARE ALTOGETHER?

The last question should be answered by both "count" and "read on the number line." Accept the answers in either order. Suggest them if the children do not. Point out the convenience of reading the total number on the number line.

HOW MANY SPACES WERE COVERED ON THE NUMBER LINE? (12, the same as the number of counters.)

HOW MANY PENNIES DID ANN AND SAM HAVE? (12, the same as the number of counters and spaces.)

B. Repeat part A as often as you feel is necessary. You may use other numbers of pennies in the above story problem and in other problems. Two more situations are suggested below.

John had 2 cats. One cat had 4 kittens and then the other cat had 3 kittens. How many kittens were there altogether? (7)

In the following example counters are used to represent events, not objects. This is a step toward the more abstract idea of addition.

> Alex went to the park 3 times one week. He went to the park 5 times the next week. How many times did he go altogether? (8)

C. Have the children complete Worksheets 5 and 6.

If a child can answer the question immediately without using counters on the number line, ask him to show how he would use counters on a number line to show the solution of a particular problem to a child who hadn't yet learned about addition.

NOTE: Your class may be interested in knowing that most kinds of squirrels will not be found in groups as large as the one shown on Worksheet 6, but these are baby red squirrels, which are found in groups of this size.

Worksheet 5
Unit 13 Name _____

7 racoons live on the north side of the farm.
3 racoons live on the south side of the farm.

7 + 3 = 10 racoons live on the farm.

6 skunks live on the north side of the farm.
5 skunks live on the south side of the farm.

6 + 5 = 11 skunks live on the farm.

Worksheet 6
Unit 13 Name _____

6 squirrels are in one tree.
3 squirrels are in another tree.

6 + 3 = 9 squirrels are in the two trees.

9 rabbits are eating clover.
2 rabbits are eating grass.

9 + 2 = 11 rabbits are eating clover and grass.

Lesson 5: COMBINING SPACES ON THE NUMBER LINE

In this lesson the children find sums by finding the total number of unit spaces when two sets of spaces are combined on the number line.

MATERIALS

— demonstration number line on the blackboard

— two colors of chalk (e.g., yellow and red)

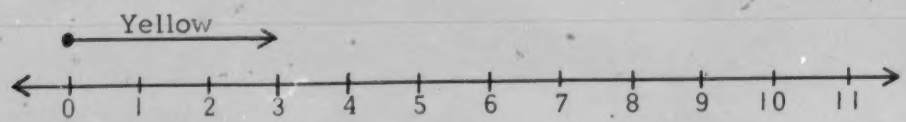
— Worksheets 7 and 8

PROCEDURE

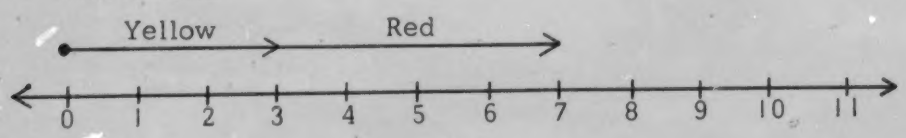
Have a demonstration number line on the board. Ask questions similar to the ones below.

HOW MANY SPACES ARE THERE BETWEEN 0 AND 3? (3)

WILL SOMEONE DRAW A YELLOW ARROW FROM 0 TO 3 TO SHOW THIS?



SUPPOSE WE JOIN THE NEXT 4 SPACES WITH THESE. WILL SOMEONE PUT A RED ARROW OVER THE SPACES TO SHOW THIS?



HOW MANY SPACES ARE NOW COVERED BY ARROWS?
(7) or (3 and 4, or 3 + 4)

WHAT IS ANOTHER NAME FOR THIS NUMBER OF SPACES?
(Whichever number name above was not given the first time.)

WE HAVE SHOWN THAT 3 + 4 IS 7.

Write 3 + 4 is 7 and also 3 + 4 = 7.

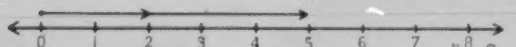
DID WE NEED TO COUNT THE SPACES TO FIND THAT WE HAD 7? (No, the numeral 7 on the number line told us that there are 7 spaces between 0 and the end point.)

WHAT DO WE CALL 3 + 4 = 7? (An addition sentence or an addition equation.)

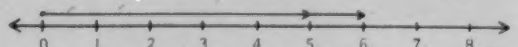
Work through as many similar problems as you feel your class needs before having them do the worksheets. Some appropriate sums that are not on the worksheets are: 5 + 2, 4 + 3, 3 + 2, and 1 + 6.

Worksheet 7
Unit 13 Name _____

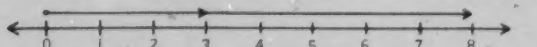
Color the first arrow over each number line green.
Color the second arrow over each number line orange.



The number of spaces under the green arrow is 2
The number of spaces under the orange arrow is 3
The number of spaces under both arrows is 5
The addition equation is 2 + 3 = 5



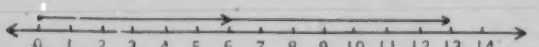
The number of spaces under the green arrow is 5
The number of spaces under the orange arrow is 1
The number of spaces under both arrows is 6
The addition equation is 5 + 1 = 6



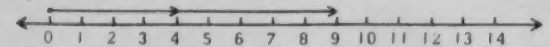
The number of spaces under the green arrow is 3
The number of spaces under the orange arrow is 5
The number of spaces under both arrows is 8
The addition equation is 3 + 5 = 8

Worksheet 8
Unit 13 Name _____

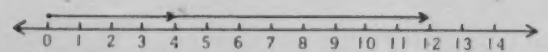
Color the first arrow over each number line blue.
Color the second arrow over each number line yellow.



The number of spaces under the blue arrow is 6
The number of spaces under the yellow arrow is 7
The number of spaces under both arrows is 13
The addition equation is 6 + 7 = 13



The number of spaces under the blue arrow is 4
The number of spaces under the yellow arrow is 5
The number of spaces under both arrows is 9
The addition equation is 4 + 5 = 9



The number of spaces under the blue arrow is 4
The number of spaces under the yellow arrow is 8
The number of spaces under both arrows is 12
The addition equation is 4 + 8 = 12

Lesson 6: MEASUREMENT AND ADDITION

The activities here combine ideas of measurement from Unit 12 with addition on the number line.

MATERIALS

- 4 nine-inch lengths of wood or cardboard (optional)
- rectangular picture (preferably mounted on cardboard)
- tape for binding picture (optional)
- ruler from Unit 12 with inch and centimeter scales
- Worksheets 9 and 10

PROCEDURE

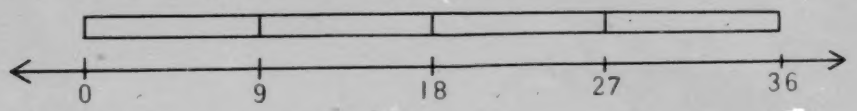
Have a number line with inch units on the chalkboard. It should be at least 36 inches long.

A. Present the following problem:

A TOY TABLE HAS FOUR LEGS. EACH LEG IS 9 INCHES LONG. THE LEGS WERE MADE BY SAWING A LONG PIECE OF WOOD INTO FOUR SHORTER PIECES.

SHOW ON THE NUMBER LINE THE LENGTH OF THE LONG PIECE OF WOOD.

Four children may draw the four legs over the number line. Or, to be more concrete, four 9-inch lengths of wood or cardboard may be taped over the number line.



WHAT IS THE ADDITION EQUATION THAT TELLS THE LENGTH OF THE LONG PIECE OF WOOD? (9 + 9 + 9 + 9 = 36)

B. Show the class a rectangular picture, preferably mounted on cardboard. Tell them that you want to know how much tape

would be needed to bind all the edges of the picture. Ask the class to suggest methods of finding the length.

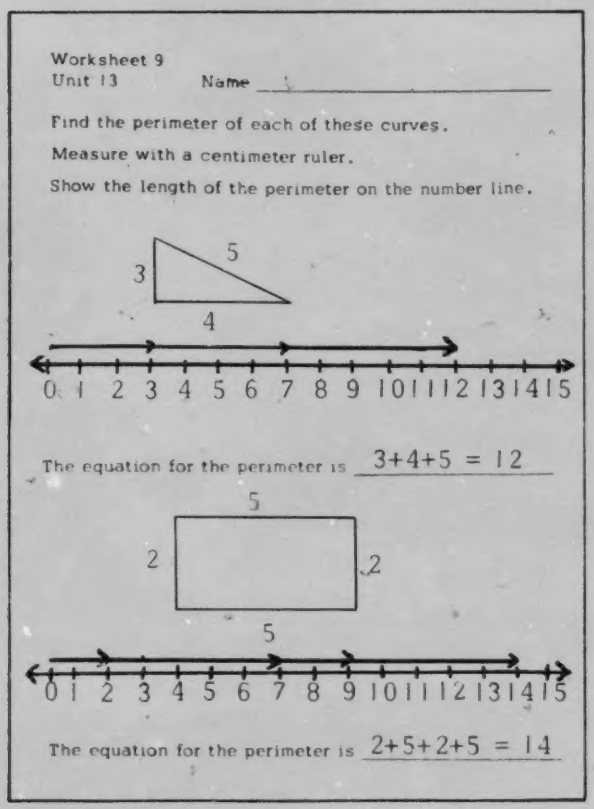
One method is to hold each side of the picture in turn against the number line and to mark its length on the line.

Another method is to measure each side with a ruler and then transfer each measurement from the ruler to the number line.

Both methods should be used, the first because it is so direct and the second because it is useful when an object cannot be placed against a number line. Follow each method by writing the appropriate addition equation.

It is not essential actually to measure the correct amount of tape and bind the picture, but if you do so, it will provide a physical illustration of the addition equation.

C. The children have had the word "perimeter" before, but you may need to review it before asking them to do Worksheet 9. Worksheet 10 refers to measurement of volume.


Worksheet 9
Unit 13 Name _____

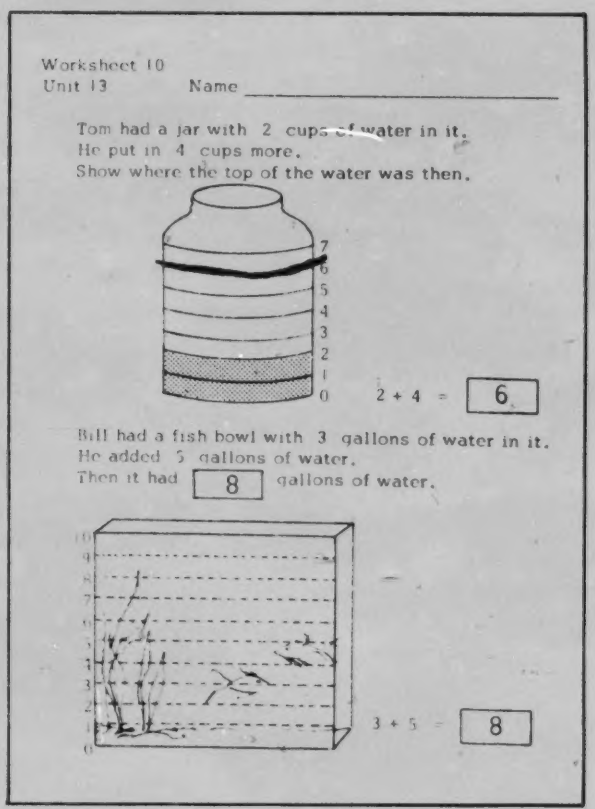
Find the perimeter of each of these curves.

Measure with a centimeter ruler.

Show the length of the perimeter on the number line.

The equation for the perimeter is 3+4+5 = 12

The equation for the perimeter is 2+5+2+5 = 14


Worksheet 10
Unit 13 Name _____

Tom had a jar with 2 cups of water in it.
He put in 4 cups more.
Show where the top of the water was then.

2 + 4 = 6

Bill had a fish bowl with 3 gallons of water in it.
He added 5 gallons of water.
Then it had 8 gallons of water.

3 + 5 = 8

Lesson 7: FINDING SUMS BY MARKING A NUMBER LINE

In this lesson the children mark number lines to find sums.

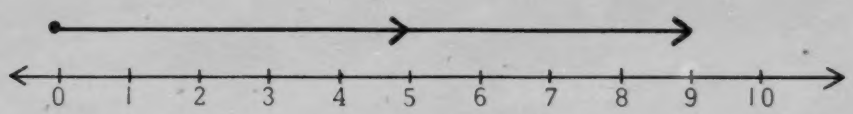
MATERIALS

- individual plastic number lines
- demonstration number line
- Worksheet 11

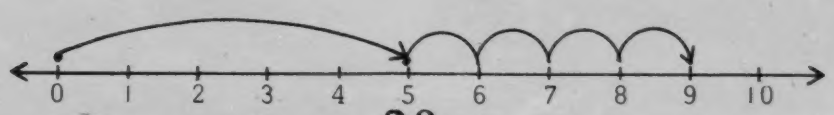
PROCEDURE

HOW CAN YOU FIND THE SUM 5 + 4 BY MARKING THE NUMBER LINE ON THE BOARD?

Probably someone will suggest using arrows as in Lesson 4. Have him show his method. It should look something like this:



Discuss this method of marking the number line. Assure the class that it is correct, but call attention to the fact that it is sometimes difficult to count units while you are drawing the second arrow. Demonstrate the following method of marking, which should be easier.

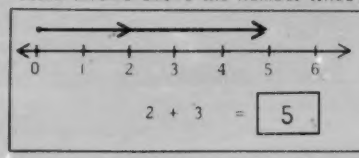


Give other examples using this method of marking the number line. Let each child mark his plastic number line and then have a volunteer mark the demonstration number line. (Of course, any child who prefers to may continue to use the straight arrows.)

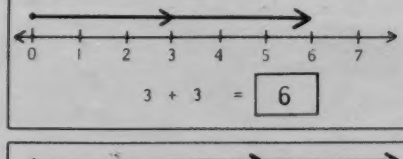
Worksheet 11 will show whether the children have the technique clearly in mind. If they do, go on to the next lesson; if not, provide more practice.

Worksheet 11
Unit 13 Name _____

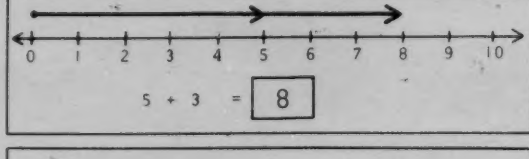
Mark arrows above the number lines.



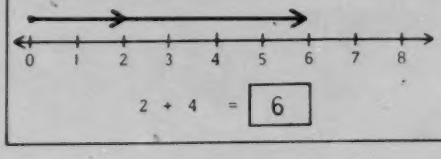
2 + 3 = 5



3 + 3 = 6



5 + 3 = 8



2 + 4 = 6

Lesson 8: ADDITION ON THE NUMBER LINE

This lesson provides practice with addition on the number line. Another method of marking the number line is shown.

MATERIALS

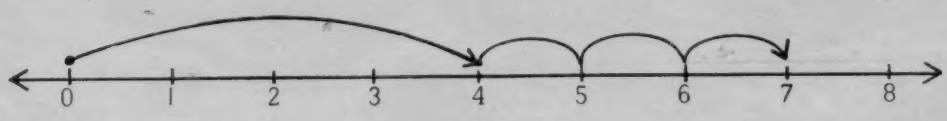
— individual plastic number lines

— demonstration number line on the board

— Worksheets 12 and 13

PROCEDURE

Have a child show 4 + 3 = 7 on the demonstration number line:



If the class understands the concept illustrated by this marking, you may suggest the shorter method of starting at the first addend.

DID YOU NEED TO COUNT THE FIRST MOVE OF 4? (No.)

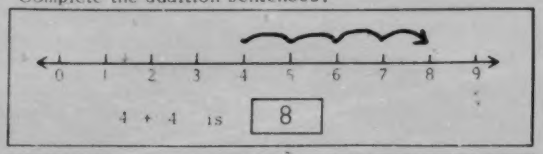
COULD YOU START AT 4, COUNT 3 SPACES, AND STOP AT 7? (Yes.)

Have the class practice this technique of marking, using their individual number lines and the demonstration line on the board. When you feel they are ready for Worksheets 12 and 13, have the children do them.

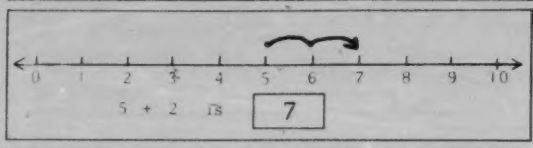
Worksheet 12
Unit 13 Name _____

Mark the number lines.

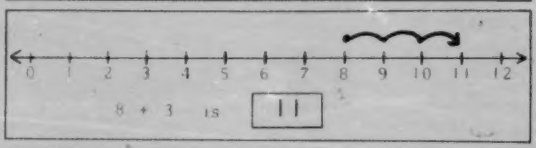
Complete the addition sentences.



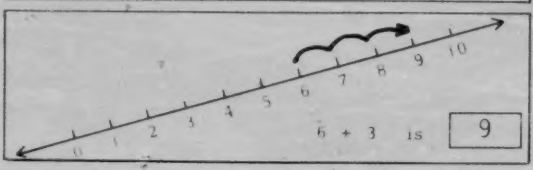
4 + 4 is 8



5 + 2 is 7



8 + 3 is 11



6 + 3 is 9

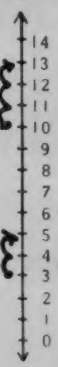
Worksheet 13
Unit 13 Name _____

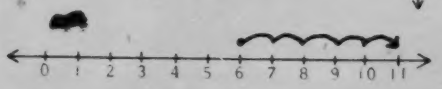
Mark the number lines.

Complete the addition equations.

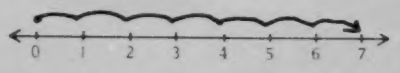
3 + 2 = 5

10 + 3 = 13





6 + 5 = 11



0 + 7 = 7

Lesson 9: STORY PROBLEMS IN ADDITION

Story problems to be solved by addition on a number line are presented in this lesson.

MATERIALS

— individual plastic number lines

— Worksheets 14, 15 and 16

PROCEDURE

The children's approaches to the problems on the worksheets will vary. Some children may need to place counters representing the quantities in the problems on their plastic number lines. Some may need to mark a number line with a crayon or pencil. Others may be able to write the equation with only a glance at the number line.

Some children may not be able to read the problems themselves. You may wish to group the children, letting one group read and work the problems independently while someone reads the problems to the others as they work.

You may wish to have the class do the problems on Worksheet 14 together.

Worksheet 14
Unit 13 Name _____

Write the number sentence for each story.

Jim had 5 pencils. John gave him 5 more.
How many did he have then?

5 + 5 = 10

I go from my house to the store.
I go 2 blocks and stop.
Then I go 3 blocks to the store.
How many blocks do I go to the store?

2 + 3 = 5

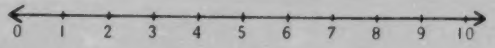
John and Carl played a game.
On his first turn, John got 3 points.
On his second turn, John got 5 points.
How many points did John get on both turns?

3 + 5 = 8

Worksheet 15
Unit 13 Name _____

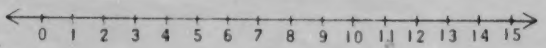
Susan had two tomato plants.
One plant had 5 red tomatoes
The other plant had 4 red tomatoes.

Together the plants had [5 + 4 = 9] red tomatoes.



Jim's peanut plant had 9 peanuts.
Tom's peanut plant had 6 peanuts.

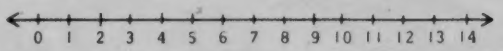
Together the plants had [9 + 6 = 15] peanuts.



Worksheet 16
Unit 13 Name _____

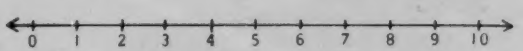
A squirrel ate 5 acorns and 7 walnuts.

He ate [12] nuts altogether.



Another squirrel ate 3 acorns and 6 walnuts.

He ate [9] nuts altogether.



Lesson 10: MISSING ADDENDS ON THE NUMBER LINE

Addition problems with a missing addend are presented. In this lesson the children will use the number line to show the information they have and then find the missing addend.

MATERIALS

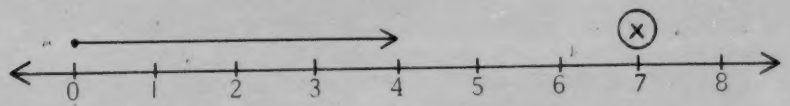
— Worksheets 17, 18 and 19

PROCEDURE

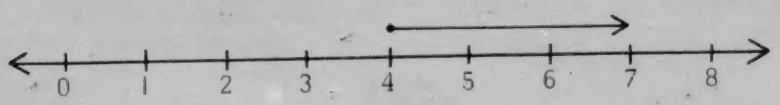
Give the children the following problem:

> Ann has 4 cents. She needs 7 cents to buy a candy bar. How many more cents does she need?

Show this story on the number line. Two possible markings are:



or



WILL SOMEONE WRITE THE EQUATION SHOWING THE PROBLEM? $(4 + \square = 7)$

WILL YOU WRITE IN THE MISSING ADDEND? $(4 + \boxed{3} = 7)$

If necessary, remind the children that a number sentence is an equation telling two names for a number. In this case the number sentence tells the number of cents Ann has and needs and the number of cents the candy costs.

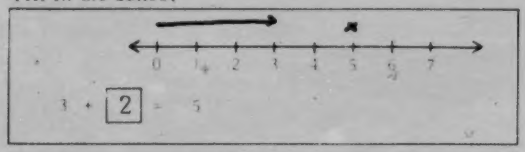
Discuss problems such as those below until you feel the class is ready for Worksheets 17, 18 and 19.

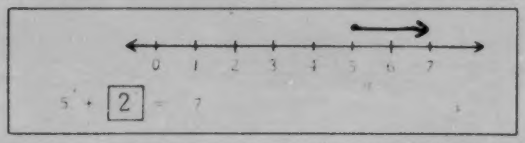
> Mike has 2 marbles. He needs 8 marbles to play a game. How many more marbles does he need?

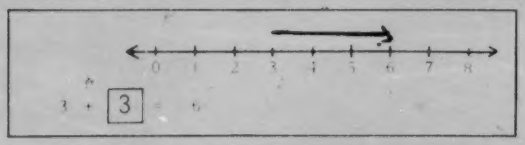
Worksheet 17
Unit 13 Name _____

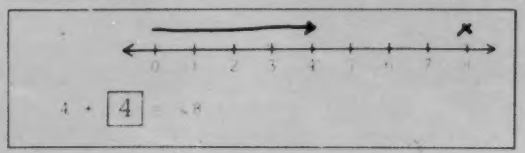
Mark the number lines.

Fill in the boxes.









I have 7 feet of rope. I need 12 feet of rope. I need ☐ more feet of rope.

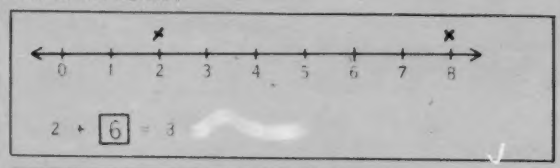
A fish is 8 inches long. How much must it grow to be 11 inches long?

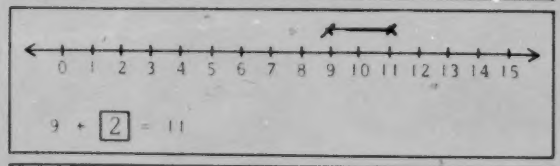
Bill has 3 more windows to wash. Then he will have washed 10 windows in all. How many windows has he already washed?

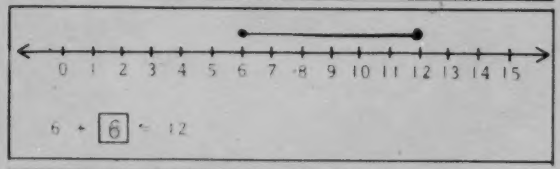
NOTE: Worksheet 19 shows a picture of a camel with two humps and some with one. The dromedary is a particular type of one-humped camel trained to carry a rider, but not all one-humped camels are dromedaries.

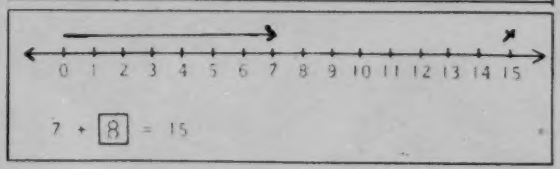
Worksheet 18
Unit 13 Name _____

Mark the number lines.
Fill in the boxes.





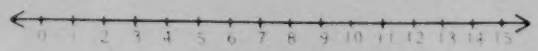




Worksheet 19
Unit 13 Name _____

There are 9 black bears in the park.
There are 6 grizzly bears in the park.
There are 15 bears in the park.

There are 8 two-humped camels in the zoo.
There are 5 one-humped camels in the zoo.
There are 13 camels in the zoo.



Lesson 11: ADDITION IN A COLUMN FORM

The traditional column form for addition is introduced as shown here:

$$\begin{array}{r} 6 \\ +\ 2 \\ \hline 8 \end{array}$$

MATERIALS

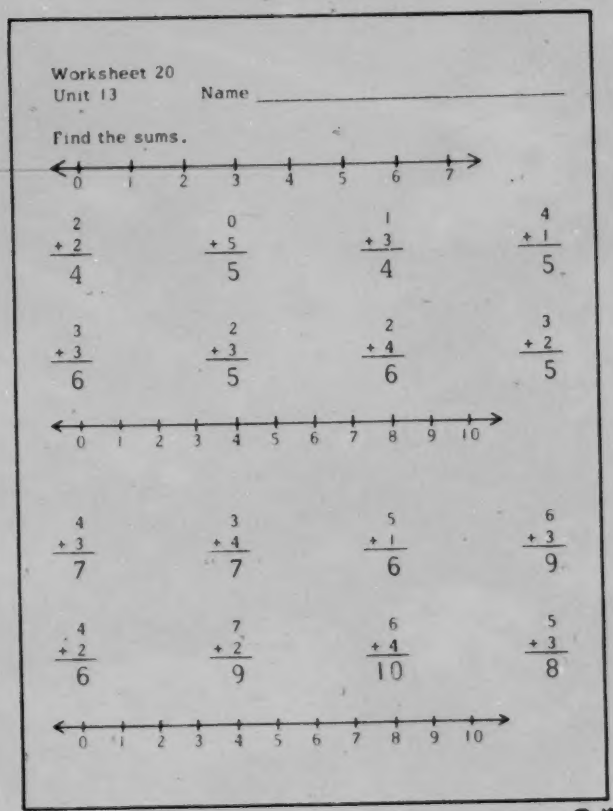
— plastic number line

— Worksheets 20 and 21

PROCEDURE

Have a child write an addition sentence in the form 6 + 2 = 8 on the board. Explain that there is another way to arrange the numerals which is especially useful when larger numbers are used. Show the vertical form.

Use Worksheets 20 and 21. Some children will rely heavily on the printed number lines, others may not need them. Those who need to mark a number line for each problem should work with their plastic number lines.



Worksheet 20
Unit 13 Name _____

Find the sums.

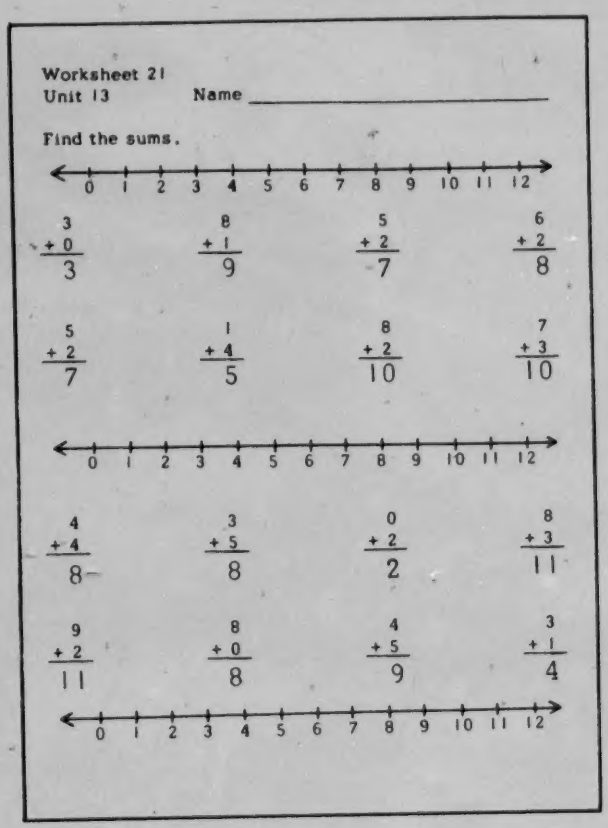
0 1 2 3 4 5 6 7

2 + 2 = 4	0 + 5 = 5	1 + 3 = 4	4 + 1 = 5
3 + 3 = 6	2 + 3 = 5	2 + 4 = 6	3 + 2 = 5

0 1 2 3 4 5 6 7 8 9 10

4 + 3 = 7	3 + 4 = 7	5 + 1 = 6	6 + 3 = 9
4 + 2 = 6	7 + 2 = 9	6 + 4 = 10	5 + 3 = 8

0 1 2 3 4 5 6 7 8 9 10



Worksheet 21
Unit 13 Name _____

Find the sums.

0 1 2 3 4 5 6 7 8 9 10 11 12

3 + 0 = 3	8 + 1 = 9	5 + 2 = 7	6 + 2 = 8
5 + 2 = 7	1 + 4 = 5	8 + 2 = 10	7 + 3 = 10

0 1 2 3 4 5 6 7 8 9 10 11 12

4 + 4 = 8	3 + 5 = 8	0 + 2 = 2	8 + 3 = 11
9 + 2 = 11	8 + 0 = 8	4 + 5 = 9	3 + 1 = 4

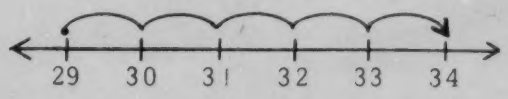
0 1 2 3 4 5 6 7 8 9 10 11 12

Lesson 12: ADDING LARGER NUMBERS ON THE NUMBER LINE

In this lesson the children learn a method of finding sums such as 29 + 5 on number lines. The lesson may be omitted from first grade work, as the same material will be included and developed further in second grade. However, for two reasons, it should also be valuable for first graders.

First, most children will see a real need for using the number line in the examples in these lessons. If only examples such as 2 + 3 are given, many children may feel that the number line is a burden rather than a help.

Second, the children may have a social need for finding such sums. If a child is sent to the store to buy a 29¢ item and a 5¢ item, he will want to know the total cost. If he has had experience with finding sums on the number line, often he will be able to obtain the sum from a mental image of 29 plus 5 more -- possibly helped by counting on his fingers.



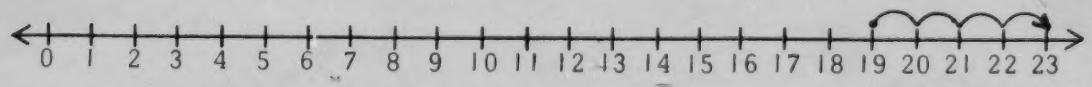
MATERIALS

— Worksheets 22 and 23

PROCEDURE

Draw a number line on the board. In this case a reasonably straight line with somewhat nonuniform markings is fine.

Write 19 + 4 = on the board. Ask for a volunteer to show the sum on a number line.

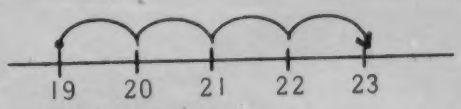


DID YOU NEED TO COUNT THE FIRST 19 SPACES?
(No, start at 19.)

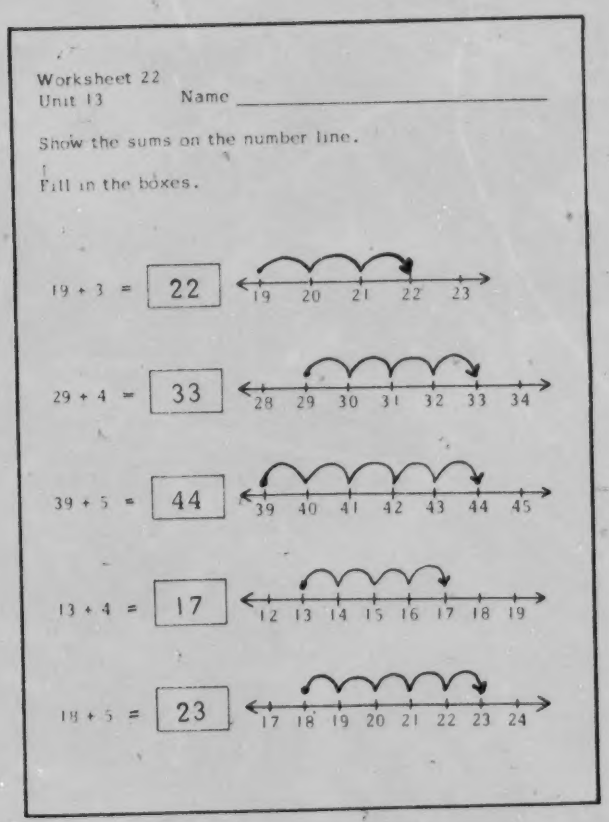
DID YOU NEED TO COUNT THE LAST 4 SPACES? (Yes.)

CAN WE JUST DRAW THE PART OF THE NUMBER LINE FROM 19 TO 23? (Yes.)

WILL SOMEONE DO THIS?



Present examples such as 18 + 3 , 23 + 4 , and 16 + 5 , until the children are ready for Worksheets 22 and 23. Children who understand larger numbers might enjoy examples such as 195 + 4 and 5629 + 6 . Obviously, the second addend should be kept small to avoid excessive marking and counting.


Worksheet 22
Unit 13 Name _____

Show the sums on the number line.

Fill in the boxes.

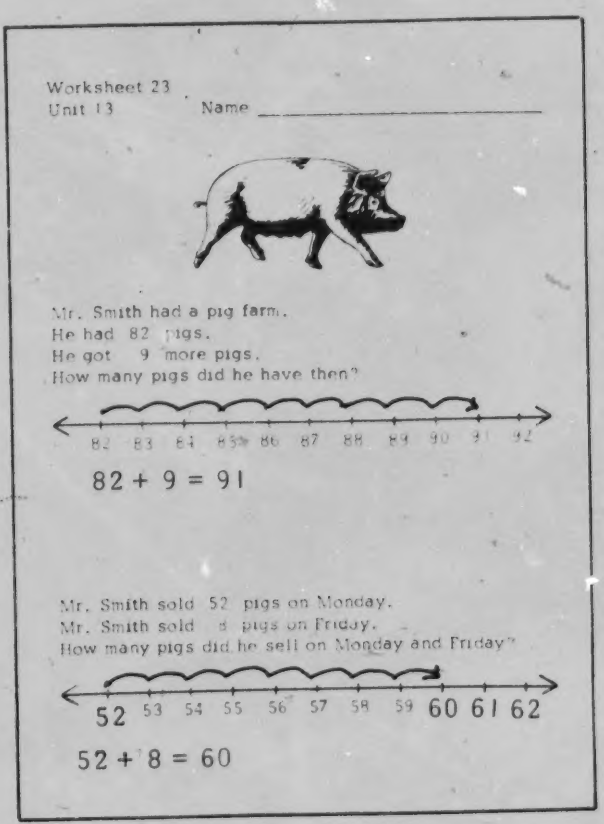
19 + 3 = 22 (19 20 21 22 23)

29 + 4 = 33 (28 29 30 31 32 33 34)

39 + 5 = 44 (39 40 41 42 43 44 45)

13 + 4 = 17 (12 13 14 15 16 17 18 19)

18 + 5 = 23 (17 18 19 20 21 22 23 24)


Worksheet 23
Unit 13 Name _____

Mr. Smith had a pig farm.
He had 82 pigs.
He got 9 more pigs.
How many pigs did he have then?

82 + 9 = 91

Mr. Smith sold 52 pigs on Monday.
Mr. Smith sold 8 pigs on Friday.
How many pigs did he sell on Monday and Friday?

52 + 8 = 60

39

SECTION 2 SUBTRACTION ON THE NUMBER LINE

The purpose of this section is to show how subtraction of the counting numbers can be interpreted by displacements or moves on the number line. First, there is a review of the set interpretation of subtraction by removal of subsets of objects. This set interpretation is extended to the cancelling of subsets of unit spaces on the number line. This in turn leads to the method of showing subtraction by displacements or moves on the number line. This last interpretation will be used in future units to interpret the subtraction of any real numbers, for example, $3 - \frac{1}{4}$ or $5 - 7$.

Various interpretations of the subtraction operation are given in this section. The problems illustrating these interpretations involve processes and questions such as the following:

Comparing two sets. (How many more are there?)
Taking away members from a set. (How many are left?)
Comparing two lengths. (How much shorter is it?)
Finding how far it is from point A to point B. (What number do I add to A to get B ?)

A few problems in this section use one-half -- for example, $5 - 1\frac{1}{2}$. These should be treated with exactly the same methods as the corresponding examples with counting numbers. Most children have had enough experience with the concept of one-half that they should need little extra guidance. However, omit the problems for those children who would have too much difficulty with them.

Lesson 13: REVIEW OF SUBTRACTION BY REMOVING SETS

The set interpretation of subtraction is briefly reviewed in this lesson. The process of finding a difference by starting with a set of objects, removing a certain subset of them, and counting the set remaining was developed in Unit 11, Introducing Addition and Subtraction.

MATERIALS

— flannel board and sets of objects (optional)

— Worksheet 24

PROCEDURE

Give the children problems similar to those below. Illustrate each problem with pictures on a flannel board or chalkboard. The starting set and the removed set should be counted by a child. As he completes the counting, write on the board, for example, 6 - 2 . Read this as "6 minus 2" and point out that it is one name for the difference of 6 and 2 . Ask the children for another name for the difference. (4) Have someone write the equation that gives both names. (6 - 2 = 4. This is sometimes called a number sentence.)

If Carl has 6 apples and eats 2 apples, he then has _____ apples. (6 - 2 = 4)

Mary has 9 pennies. She loses 5 of them. She then has _____ pennies. (9 - 5 = 4)

Bill has 8 green, red, and blue pencils in a box. He takes out all 3 of the red pencils. How many pencils are left in the box? (5 = 8 - 3) What colors are the pencils left in the box? (Green and blue.) If 2 pencils are green, how many blue ones are there? (5 - 2 = 3)

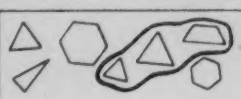
Worksheet 24 will indicate whether any children need more review of this type of problem.

Worksheet 24
Unit 13 Name _____

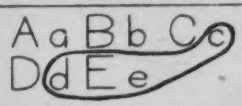
Write the number sentence for each picture.

The curve shows the subset to take away.

3 - 1 = 2

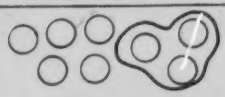


7 - 3 = 4



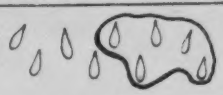
10 - 4 = 6

6 - 2 = 4

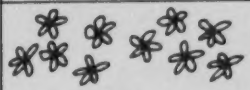


8 - 3 = 5

4 - 2 = 2



9 - 5 = 4



10 - 0 = 10

Lesson 14: SUBTRACTION WITH COUNTERS ON A NUMBER LINE

This lesson is planned to help the children transfer from the idea of removing a subset from a given set of objects to the idea of removing a subset from a set of unit spaces on the number line. Of course no spaces can actually be removed from the number line, but some spaces can be removed from the set being considered in a problem.

MATERIALS

-- for each child --

— 1 number line (0 to 15 or more) - for his desk

— 15 or more counters small enough to fit on the number line spaces

The number lines can be plastic number lines, tapes for the addition slide rule, or printed number lines in an appropriate size.

PROCEDURE

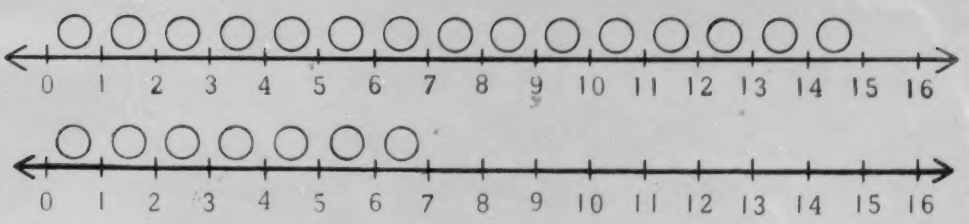
Each child should have on his desk a number line, 15 counters, paper and a pencil. The 20-hole pegboard number line can be used for demonstration if you wish.

A. Give the class this problem:

Charles had 15 dollars. He spent 8 dollars. How many dollars did he have left?

Ask the children to suggest methods for finding the answer. Accept and discuss all reasonable suggestions, but guide the discussion so that the following ideas are brought out:

Let one counter stand for one dollar. Count 15 counters by placing counters in the spaces on the number line beginning in the space between 0 and 1. Then take away 8 counters to show that Charles spent 8 dollars.



HOW MANY COUNTERS ARE LEFT? (7)

HOW MANY UNIT SPACES ARE STILL COVERED? (7)

WRITE THE SUBTRACTION EQUATION FOR THIS PROBLEM. (15 - 8 = 7)

Children might remove counters from either end, or from any position. Have children show their methods. Then explain that any of these methods is correct. But if you start at 15 to remove the subset of 8 , the number of the subset remaining can be read from the number line without counting. If the counters are removed starting from the left, the set being removed does not need to be counted, but the difference set that remains needs to be counted.

B. Repeat the procedure given above in as much detail as you desire with problems similar to those following. Have the children make up their own problems. Ask the children whether they need to count the set of counters they start with. (No, the number line will show the total number in the set.) Suggest that they remove counters from the right. Ask whether they need to count the subset removed. (Yes.) Do they need to count the subset remaining? (No. The number line will show the number in the final subset.)

Herman designed 8 rockets. When the rockets were tested, only 4 went into orbit. How many rockets failed to go into orbit? (8 - 4 = 4)

Herman designed 8 new rockets. When these rockets were tested, 6 went into orbit. How many rockets failed to go into orbit? (8 - 6 = 2)

Is Herman improving? How many more successes did he have the second time? (6 - 4 = 2)

Lesson 15: SUBTRACTION BY MOVING LEFT ON THE NUMBER LINE

Here arrows are used to show movements over a certain number of spaces on the number line.

MATERIALS

- demonstration number line on the blackboard
- two colors of chalk (e.g., red and blue)
- Worksheets 25 and 26

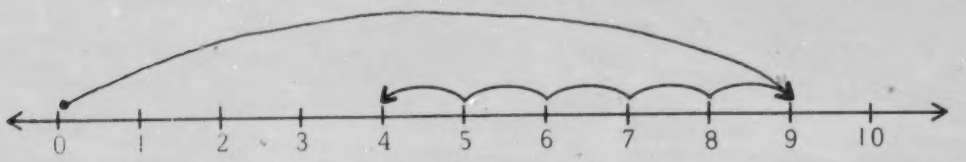
PROCEDURE

A. Display a number line and ask questions similar to these:

HOW MANY SPACES ARE BETWEEN 0 and 9 ? (9)

WILL SOMEONE DRAW A BLUE ARROW FROM 0 to 9 TO SHOW THIS? (This arrow may be straight or curved.)

NOW WILL SOMEONE DRAW A RED ARROW TO SHOW THAT WE ARE COMING BACK 5 SPACES FROM 9 ? (Any sort of arrow is acceptable.)



DID YOU NEED TO COUNT THE SPACES TO DRAW THE RED ARROW? (Yes.)

HOW MANY SPACES ARE BETWEEN 0 AND THE END OF THE RED ARROW? (4)

DID YOU NEED TO COUNT TO FIND THAT THERE WERE 4? (No. This can be read from the number line.)

HOW IS THIS LIKE REMOVING A SUBSET OF OBJECTS? (We went back over -- or cancelled -- some of the spaces that we first covered.)

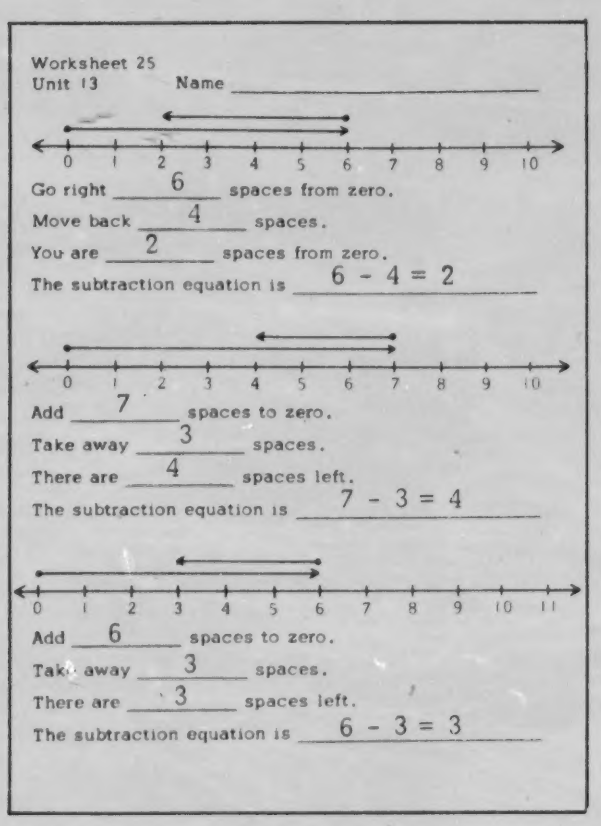
NOW LET'S WRITE THE EQUATION FOR THIS PROBLEM. WE NEED TWO NAMES FOR THE NUMBER IN THE SET OF SPACES LEFT. WHAT ARE THESE NAMES? (9 - 5, and 4)

WILL SOMEONE WRITE THE EQUATION? (9 - 5 = 4)

B. Work through an appropriate number of similar problems with the class. Some suitable differences that are not on the worksheets are 4 - 3 , 10 - 3 , and 8 - 5 .

In each case the arrow forward (to the right) shows we are moving a certain number of spaces right from 0 and the arrow backward (to the left) shows we are moving back toward 0 a certain number of spaces. This idea is an introduction to the more general concept of showing addition and subtraction by displacements on the number line.

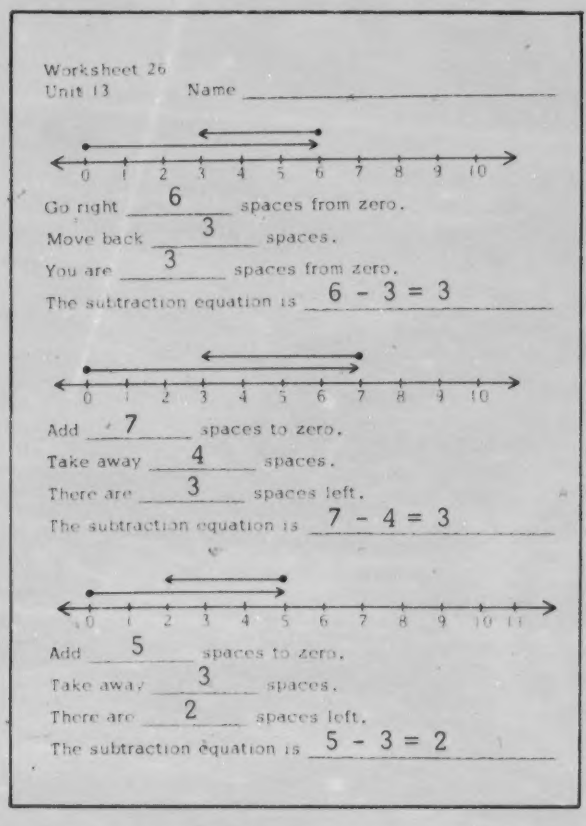
C. Have the class do Worksheets 25 and 26.


Worksheet 25
Unit 13 Name _____

Go right 6 spaces from zero.
Move back 4 spaces.
You are 2 spaces from zero.
The subtraction equation is 6 - 4 = 2

Add 7 spaces to zero.
Take away 3 spaces.
There are 4 spaces left.
The subtraction equation is 7 - 3 = 4

Add 6 spaces to zero.
Take away 3 spaces.
There are 3 spaces left.
The subtraction equation is 6 - 3 = 3


Worksheet 26
Unit 13 Name _____

Go right 6 spaces from zero.
Move back 3 spaces.
You are 3 spaces from zero.
The subtraction equation is 6 - 3 = 3

Add 7 spaces to zero.
Take away 4 spaces.
There are 3 spaces left.
The subtraction equation is 7 - 4 = 3

Add 5 spaces to zero.
Take away 3 spaces.
There are 2 spaces left.
The subtraction equation is 5 - 3 = 2

Lesson 16: FINDING DIFFERENCES BY MARKING A NUMBER LINE

In this lesson the children find differences by marking number lines. An efficient method of marking the number line is shown.

MATERIALS

— demonstration number line

— individual plastic number lines

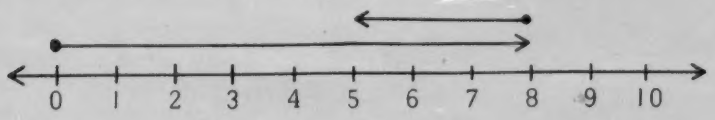
— Worksheets 27, 28 and 29

PROCEDURE

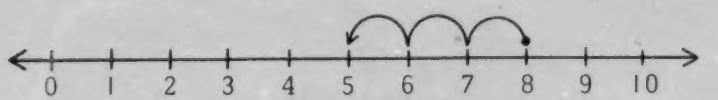
A. Give the class a problem such as this:

> Mike had 8 feet of rope. He cut off 3 feet to give to Joe. How many feet of rope did Mike have left?

Ask someone to show this problem on the number line. Probably he will mark arrows over the line.



Discuss this marking, assuring the class that it is correct and shows the problem well. However, bring out the idea that the arrow from 0 to 8 does not need to be drawn, since the numeral 8 on the number line shows where the arrow to the left should start. A short way of marking the line is to start at 8 and count 3 spaces to the left.



Repeat this problem with different rope lengths or devise similar problems. Use combinations such as 9 - 3, 4 - 4, 7 - 3, 7 - 7. Have the children mark their plastic number lines. Then have a volunteer mark the demonstration number line.

B. Handling the actual material for measurement problems similar to that given above will provide practice in measurement and subtraction. It will reinforce the association between length and number which is implicit in the use of the number line.

A child can measure and cut a certain length of yarn, string, paper, or wood. The length should be recorded on a number line (not necessarily with the same units as on the scale used to measure the length). He should then measure and cut off a piece of his string. The length of this piece should be recorded on the same number line. Next, studying the marked number line, he should predict the length of the remaining string. This length can then be checked by direct measurement of the remaining string.

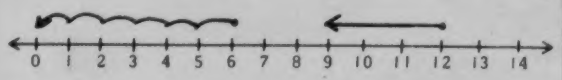
C. (Optional) If you are sure your class understands marking number lines to show differences of counting numbers, extend the concept to combinations where a half-space must be marked, such as $5 - \frac{1}{2}$, $3\frac{1}{2} - 2$, $6 - 1\frac{1}{2}$. For example, give the problem below to the class. Have the children mark their number lines as they did when using only counting numbers.

Mary had 5 feet of yarn.
She used up $\frac{1}{2}$ foot of yarn.
How many feet of yarn were left?

D. Have the class do Worksheets 27, 28 and 29.

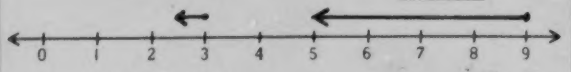
Worksheet 27
Unit 13 Name _____

Find the differences by marking the number line.



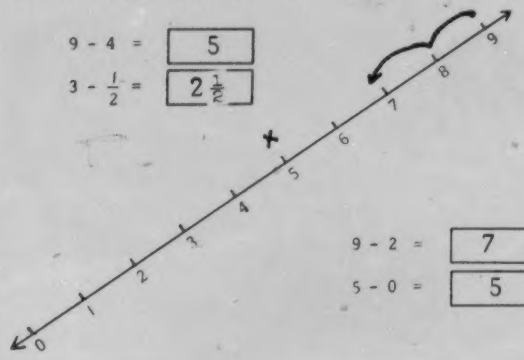
12 - 3 = 9

6 - 6 = 0



9 - 4 = 5

$3 - \frac{1}{2} = 2\frac{1}{2}$



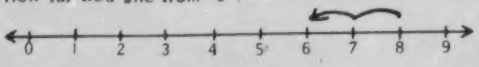
9 - 2 = 7

5 - 0 = 5

Worksheet 28
Unit 13 Name _____

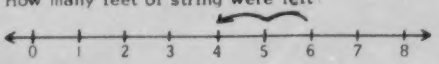
Show the story on the number line.
Write an equation for each story.

In a game, Sally went 8 spaces forward.
Then she had to go back 2 spaces.
How far was she from 0 ?



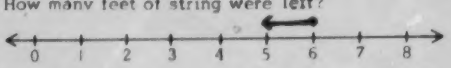
8 - 2 = 6

Dick had 6 feet of string.
2 feet broke off.
How many feet of string were left?



6 - 2 = 4

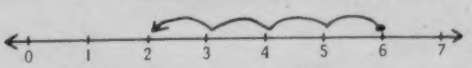
Tom had 6 feet of string.
1 foot broke off.
How many feet of string were left?



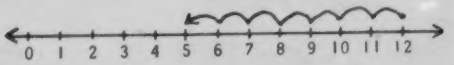
6 - 1 = 5

Worksheet 29
Unit 13 Name _____

Joe had one corn stalk with 6 ears on it.
Joe picked 4 ears from the stalk.
The stalk had 6 - 4 = 2 ears left.



One ear of corn had 12 husks.
Joe took off 7 husks.
The ear had 12 - 7 = 5 husks left.



Lesson 17: SUBTRACTION IN COLUMN FORM

This lesson introduces the column form for writing subtraction problems, e.g.,

$$\begin{array}{r} 6 \\ -\ 2 \\ \hline 4 \end{array}$$

It also provides practice in finding simple differences.

MATERIALS

— Worksheets 30, 31 and 32

PROCEDURE

Have a child complete a subtraction equation in the form $6 - 2 = 4$ on the board. Explain that this is often arranged in another way which will be especially useful later when larger numbers are used. Show the vertical form.

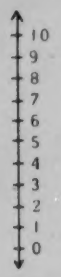
Number lines are printed on Worksheets 30 and 31 for those who wish to use them. Other children may wish to use counters or fingers. Still others may have memorized these simple differences.

Worksheet 32 has subtraction of money. Explain to the children that the number lines for the problems here are shown by the scales on stacks of pennies.

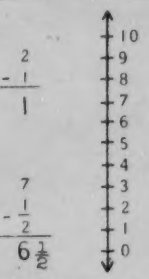
Worksheet 30
Unit 13 Name _____

Find the differences. If you want to, you may use the number lines.

6 − 2 = 4	4 − 1 = 3	5 − 3 = 2	7 − 2 = 5
3 − 3 = 0	4 − 2 = 2	9 − 2 = 7	8 − 3 = 5

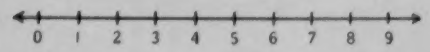


4 − 4 = 0	5 − 4 = 1	3 − 2 = 1	2 − 1 = 1
8 − 7 = 1	9 − 4 = 5	4 − 0 = 4	7 − $\frac{1}{2}$ = $6\frac{1}{2}$

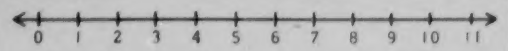


Worksheet 31
Unit 13 Name _____

If you want to, use the number lines to find the differences.



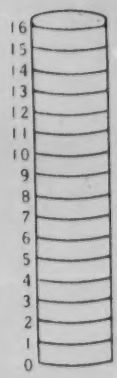
6 − 4 = 2	5 − 1 = 4	2 − 1 = 1	1 − 0 = 1
6 − 3 = 3	7 − 4 = 3	8 − 6 = 2	9 − 1 = 8

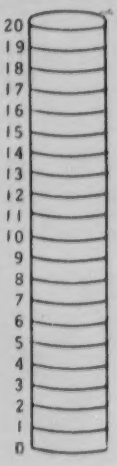


9 − 3 = 6	9 − 8 = 1	4 − 3 = 1	7 − 6 = 1
5 − 2 = 3	$8\frac{1}{2}$ − 4 = $4\frac{1}{2}$	10 − 1 = 9	10 − $1\frac{1}{2}$ = $8\frac{1}{2}$

Worksheet 32
Unit 13 Name _____

16 cents − 4 cents = 12 cents	20 cents − 10 cents = 10 cents
10 cents − 5 cents = 5 cents	12 cents − 4 cents = 8 cents
15 cents − 6 cents = 9 cents	12 cents − 3 cents = 9 cents
11 cents − 4 cents = 7 cents	6 cents − 5 cents = 1 cents





Lesson 18: SUBTRACTING FROM A LARGER NUMBER

This lesson presents differences where one number is larger than 20 . These differences, e.g., 21 - 3 , are to be found on number lines. The lesson may be omitted from first grade work, as the same material will be included in second grade, but if your class is able to do it, it is recommended for two reasons:

First, most children will find they really need the number line for finding the answers to the problems in the lesson. This is in contrast to the differences of two numbers each less than 10 (for example, 7 - 2) where many children may prefer other methods and feel that the number line is not a great help. A full discussion of the importance of using the number line appears in the introduction to Unit 11.

Second, many subtraction problems in other first grade studies or in everyday life involve numbers larger than 10 or 20 .

MATERIALS

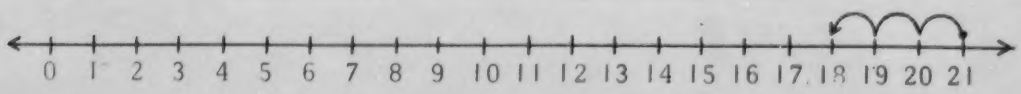
— Worksheets 33, 34 and 35

PROCEDURE

A. This lesson requires counting and ordering large numbers. Some children will probably need more practice with this skill before going on. One way of providing this practice is to show the children a numeral on a card, e.g. 48, and ask:

WHAT NUMBER COMES AFTER 48 ? (49)
or
WHAT NUMBER COMES BEFORE 48 ? (47)

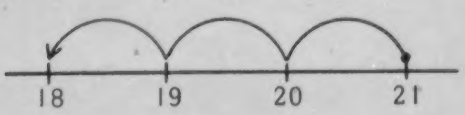
B. Have a number line from 0 to 22 drawn on the board. Ask for a volunteer to show the difference 21 - 3 on the number line on the board. He should start at 21 and move 3 to the left. The marking might look like this:



Assure the child that he showed the difference properly, but that there is a way of showing it that doesn't use so many numerals.

COULD WE JUST SHOW THE PART OF THE NUMBER LINE UNDER THE ARROW SHOWING THE MOVE TOWARD THE LEFT? (Yes.)

LET'S SHOW WITH A MARK THAT WE ARE STARTING AT 21, AND THEN COUNT BACK 3 UNITS TO THE LEFT. IN THIS WAY WE USE ONLY THAT PART OF THE NUMBER LINE THAT WE NEED.



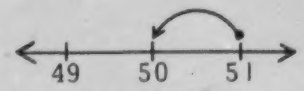
WHAT SUBTRACTION EQUATION HAVE WE SHOWN?
(21 - 3 = 18)

C. Guide the children through problems similar to the following. They can draw segments of the number line on paper and mark arrows on them.

Janet had 95 cents. She spent 6 cents. How many cents did she have left?

Father had 21 dollars. He spent 3 dollars. How many dollars did he have left?

Jane had a collection of 82 shells. She gave 4 shells to her sister. How many shells did Jane have left in her collection?

D. Draw diagrams similar to 

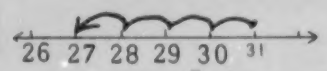
on the board. Have the children make up story problems to go with the diagrams. The appropriate equations should be written.

E. Have the children do Worksheets 33, 34 and 35.

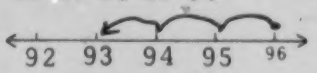
Worksheet 33
Unit 13 Name _____

Find the differences.

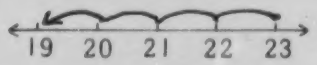
31 - 4 = 27



96 - 3 = 93

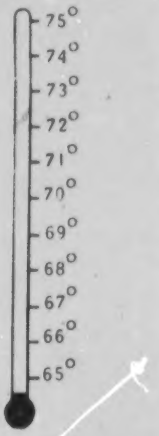


23 - 4 = 19



$\begin{array}{r} 70^{\circ} \\ -\ 5^{\circ} \\ \hline 65^{\circ} \end{array}$ $\begin{array}{r} 73^{\circ} \\ -\ 5^{\circ} \\ \hline 68^{\circ} \end{array}$

$\begin{array}{r} 72^{\circ} \\ -\ 3^{\circ} \\ \hline 69^{\circ} \end{array}$ $\begin{array}{r} 74^{\circ} \\ -\ 6^{\circ} \\ \hline 68^{\circ} \end{array}$



Worksheet 34
Unit 13 Name _____

Ann started to school with 14 maple leaves.
She lost 5 maple leaves.
She had 14 - 5 = 9 maple leaves left.

Jane started to school with 18 oak leaves.
On the way she gave 5 oak leaves to Sam.
She had 18 - 5 = 13 oak leaves left.

Worksheet 35
Unit 13 Name _____

Mother's rosebush had 43 buds.
6 buds opened today.
How many buds are left?
43 - 6 = 37

Sue's violet plants had 51 blossoms.
Sue picked 5 blossoms.
How many blossoms were left?
51 - 5 = 46

Tom's tulip plants had 32 blossoms.
Tom picked 4 blossoms.
How many blossoms were left?
32 - 4 = 28

Lesson 19: HOW MANY MORE OR FEWER?

The comparison of the number of members in two sets by one-to-one pairing of the sets is reviewed. A connection is made between this comparison and the use of subtraction to answer questions about how many more or fewer members are in one set than are in the other.

MATERIALS

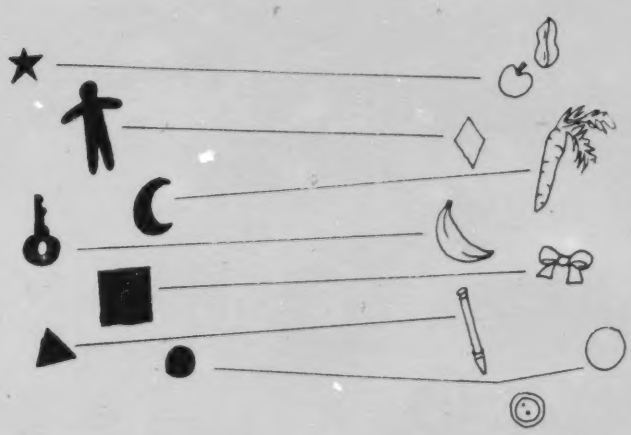
- two colors of chalk, or flannel board with two sets of objects containing about 8 and 10 members
- Minnebars
- individual number lines
- Worksheets 36, 37 and 38

PROCEDURE

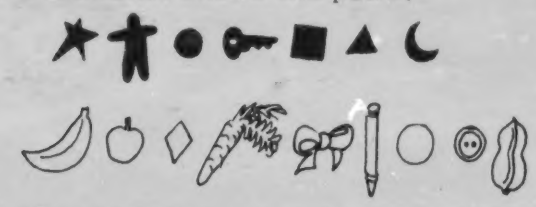
A. Show two sets of objects containing 9 and 7 members. These sets may be flannel board objects (preferable) or pictures drawn on the board. (Draw one set in each color.)

CAN SOMEONE TELL US HOW WE COMPARED THE NUMBERS OF MEMBERS IN TWO SETS BEFORE WE COUNTED THEM? (We paired members of the sets by one-to-one correspondence.)

The pairings can be shown by connecting lines:



The pairing can also be shown by rearranging the objects into a form that shows the pairs:



After both forms are shown, ask

WHICH SET HAS MORE MEMBERS? (The light-colored set.)

HOW MANY MORE? (The light set has 2 more members than the dark set.)

Explain that the difference between the numbers of members in the two sets is the number of unpaired objects. The number of unpaired objects can be found by subtracting the number in the dark set from the number in the light set, $9 - 7 = \boxed{2}$, or by finding the number that must be added to the number in the dark set to get the number in the light set, $7 + \boxed{2} = 9$.

B. Have each child place two Minnebars of different lengths on his desk. (We will assume they are the 9-unit and 6-unit bars and that they are purple and dark green.)

WHICH BAR IS LONGER? (The purple one.)

HOW CAN YOU TELL? (Place the bars next to one another so the unit squares are paired.)

HOW MUCH LONGER IS THE PURPLE BAR? (3 unit squares.)

HOW MUCH SHORTER IS THE DARK GREEN BAR? (3 unit squares.)

CAN YOU WRITE AN EQUATION DESCRIBING THIS? ($9 - 6 = 3$, or $6 + 3 = 9$)

C. Give the class a problem such as this one:

Sally found 5 shells. Dick found 8 shells. Who found more shells? (Dick) How many more shells did Dick find? (3) How many fewer shells did Sally find? (3)

Have this problem illustrated by objects in a row on the chalkboard, and have the equations written: $8 - 5 = 3$ and $5 + 3 = 8$.

COULD WE SHOW THIS ON A NUMBER LINE WITHOUT DRAWING ALL THE SHELLS? (Yes, let each space on the number line represent a shell. Mark the number line to show the relations expressed by the equations.)

Guide the children through problems similar to the following until you are satisfied with their grasp of the concept. Either the subtraction or missing addend relation can be used. They can mark the numbers on their number lines.

Tom has 12 cents. Bill has 9 cents. How many more cents does Tom have?

Sally has 10 books and Jane has 8 books. How many fewer books does Jane have? How many more books does Sally have?

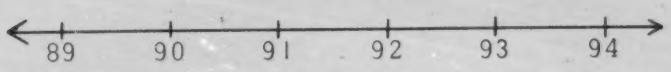
D. (Optional) If your class can work with larger numbers easily, extend the first part of the lesson to include them. The following problem can be used:

David has 94 marbles. Sam has 89 marbles. How many more marbles does David have?

WE WILL SHOW THE NUMBERS OF MARBLES ON A NUMBER LINE.

MUST WE DRAW THE PART OF THE NUMBER LINE FROM 0 TO 94? (No, only the part we need.)

WILL SOMEONE SHOW 94 AND 89 ON THE SAME SEGMENT OF A NUMBER LINE?



HOW MANY MORE MARBLES DOES DAVID HAVE? (5, the difference of 94 and 89.)

Worksheet 36
Unit 13 Name _____

The class put balloons around the room for a party.

There were 8 round balloons.
There were 6 long balloons.
There were [2] more round balloons than long balloons.
The equation is 8 - 6 = 2

There were 3 cat balloons.
There were 8 round balloons.
There were [5] fewer cat balloons than round balloons.
The equation is 8 - 3 = 5

There were 6 long balloons.
There were 3 cat balloons.
There were [3] more long balloons than cat balloons.
The equation is 6 - 3 = 3

E. Three worksheets are part of this lesson. Worksheet 36 should be done by all the children. Worksheets 37 and 38 involve differences of larger numbers. You may wish to have only selected children do them. Or, you may wish to do these worksheets as a class, with more guidance than usual.

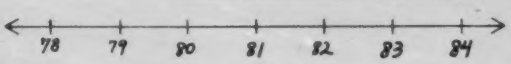
NOTE: The frog shown below is a tree frog.

Worksheet 37
Unit 13 Name _____

One day a frog ate 84 insects.
That night a toad ate 79 insects.

Which ate more insects? the frog

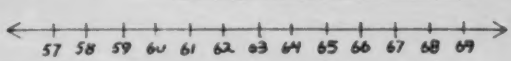
How many more? 84 - 79 = 5



The next day the frog ate 59 insects,
and the toad ate 67 insects.

Which ate more? the toad

How many more? 67 - 59 = 8

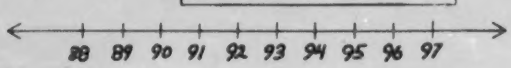


Worksheet 38
Unit 13 Name _____

One evening a nighthawk ate 97 mosquitoes.
The same evening a swallow ate 89 mosquitoes.

Which bird ate more mosquitoes? the nighthawk

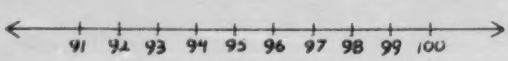
How many more? 97 - 89 = 8



The next evening the nighthawk ate 100 mosquitoes,
and the swallow ate 92 mosquitoes.

Which bird ate more mosquitoes? the nighthawk

How many more? 100 - 92 = 8

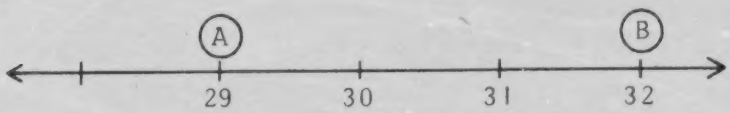


Lesson 20: DIFFERENCES AND MEASUREMENTS

Here the children measure various objects and consider the differences of the measurements. The close connection between subtraction problems and the corresponding missing addend problems is illustrated.

COMMENTARY

Suppose object A is measured and found to be about 29 inches long. Object B is found to be about 32 inches long. These lengths can be recorded on a segment of a number line.



Three questions that we could ask about these lengths are:

HOW MUCH LONGER IS B THAN A ? (3" , because $29 + \boxed{3} = 32$)

HOW MUCH SHORTER IS A THAN B ? (3" , because $32 - \boxed{3} = 29$)

WHAT IS THE DIFFERENCE IN THE LENGTHS OF A AND B ? (3" , because $32 - 29 = \boxed{3}$)

Each of these questions has the same answer, but each time a different equation was used to obtain the answer. Of course, the equations are very closely related.

Any time we are interested in the difference between two quantities, questions leading to either subtraction or missing addend equations can be asked. The precise shades of meaning implied by the equations are difficult for children to explain. However, the answers to the questions about differences are usually easy to see in specific situations. This lesson will present such situations with the expectation that the children's experience with them will help them understand the relation between subtraction and the missing addend.

MATERIALS

— ruler with centimeter and inch scales

— yardstick or tape measure with foot scale

PROCEDURE

In the following activities accept any correct equation involving either subtraction or the missing addend concept. Always have the equation written and the quantities recorded on a number line.

A. Have each child place two pencils or crayons of different lengths on his desk. He should place them side by side along the centimeter scale of his ruler, and read the difference.

HOW MUCH LONGER IS THE LONGER PENCIL THAN THE SHORTER? (Any of the following types of answers is acceptable: 1 cm., between 1 and 2 cm., about 1 cm., a little more than 1 cm.)

Repeat this activity as you wish with objects that the children choose. Use rulers, yardsticks, tapes, etc.

B. Have children measure the length and the width of the classroom in feet. Have the measured number of feet in each case recorded on a number line. Accept considerable error in the measurements.

HOW MUCH LONGER IS OUR ROOM THAN IT IS WIDE?

C. Have all the children measured. Record on the board the heights to the nearest half inch. Mark the heights of the tallest and shortest on a segment of a vertical number line.

HOW MUCH SHORTER IS THE SHORTEST THAN THE TALLEST?

HOW MUCH WILL THE SHORTEST HAVE TO GROW TO BE AS TALL AS THE TALLEST IS NOW?

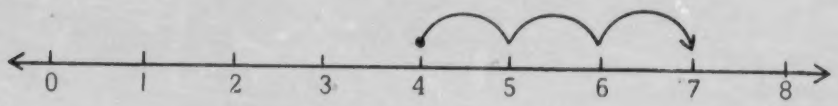
Have the children at the two extremes stand on either side of a tape or other scale. Read the differences in height.

Note that the children are to measure and record half-units. One value of this is that it shows that a point between two integers on a scale also is associated with a definite number.

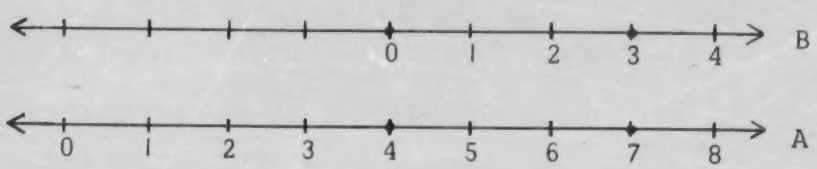
(If you feel that comparing heights would be unpleasant for certain children, ask for a few to volunteer to be measured.)

SECTION 3 THE ADDITION SLIDE RULE

When finding a sum on a number line, for example, $4 + 3$, the number of intervals between 0 and the point corresponding to the first addend need not be counted but can be read from the line. However, the number of intervals corresponding to the second addend must be counted because the number of unit spaces between 4 and 7 is difficult for a child to read.



Using two number lines allows both addends to be read directly. To see this, consider again the sum $4 + 3$. Draw two parallel number lines of the same scale. Mark the first addend, 4, on the lower number line, line A. On the upper number line, line B, call the point directly above 4 of line A the 0 of number line B. The second addend, 3, can now be read directly on line B. Straight down from 3 is the sum, 7, on line A. As you can see, this is just another way of counting intervals.



The addition slide rule, as furnished by MINNEMAST, is a device that uses these ideas. It is a plastic holder for two number line tapes. The frame holds the upper number line fixed and permits the lower one to be moved.

Most children enjoy manipulating the slide rules. Finding sums with the slide rule will reinforce the concept of the one-to-one relationship between numbers and points on the number line, and will also provide practice with addition combinations.

Again in this section, certain problems use nonintegral numbers such as $3\frac{1}{2}$. These problems should not be difficult for most children, because they always involve the same concepts and methods as the corresponding problems with counting numbers. We introduce numbers containing $\frac{1}{2}$ as an illustration of the fact that arithmetical operations apply to all real numbers and not just the counting numbers. The slide rule is an excellent device to show this. If the child understands $1 + 2$ as shown on the slide rule, and then moves one scale to show $1 + 3$, it should be easy for him to understand that in the same way 1 can also be added to $2\frac{1}{2}$ or to any other point between 2 and 3.

Lesson 21: SHOWING NED HOW TO ADD

This lesson uses a story problem and blackboard diagrams to introduce addition with two parallel number lines.

STORY

Andy and Bill were invited to a picnic in a brand new park they had never been to before.

Andy phoned Bill so they could talk about how to get to the park.

"Should we walk, or ride bikes, or see if one of our mothers can take us?" Andy asked. "How far is it? Where is it?"

"I don't know how far it is," Bill answered, "but it is on the same street that we both live on. If you start at your house and go straight down the street right past my house, you will get to it after a while."

"Shall we try riding our bikes to the park today? Then we can find out how far it is," Andy said.

"No, we don't need to do that. My mother knows how far the park is from our house, and if you know how far it is from your house to our house, we can get the answer."

Andy answered, "I don't know exactly how far it is to your house, but I can ride over on my bike right now and count the blocks."

"That's a good idea, Andy," Bill said. "I'll be watching for you from the front porch."

After a while Bill saw Andy riding along across the street. He heard Andy shout, "Eight, eight! It's eight blocks from my house to your house."

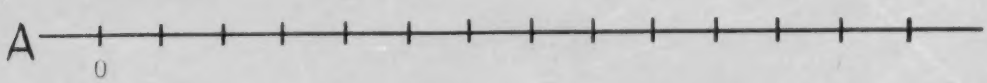
When Andy crossed the street to Bill's house, Bill told him, "My mother says it's four blocks from our house to the park. Now we know how far we will have to ride our bikes. It's 8 blocks and 4 blocks added together or 12 blocks in all."

"How do you know 8 blocks and 4 blocks are 12 blocks altogether?" asked Ned, Bill's little brother.

"We'll draw you a picture so you can see it," answered Andy.

"Let this line be my side of our street," said Andy as he drew a long line with a ruler. "I'll mark the line A for Andy, and I'll mark the corner where my house is with 0 ."

(Draw a line on the board and measure off units and mark. Put in 0 .)

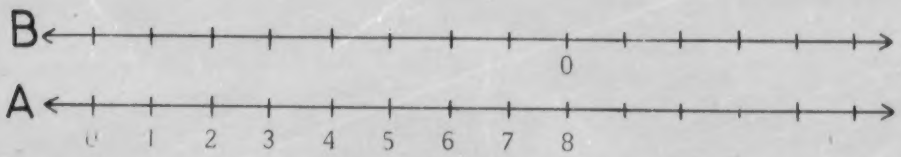


"I'll mark the end of the first block 1 . I'll mark the end of the second block 2 . I'll number the blocks until I get to 8 , which is the corner where you live."

(Have volunteers do this numbering.)

"Now I'll draw our side of the street," said Bill. "I'll mark this line B for Bill, and our house will be 0."

(Draw line and mark units. Ask a child to mark the 0 for Bill's house on the B line.)

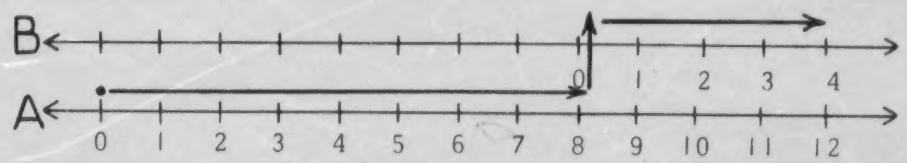


"Next I'll number the blocks from our house to the park."

(Have a child do this numbering.)

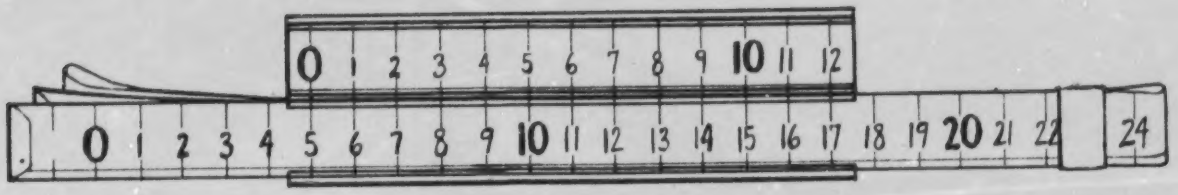
"I can see that it is 8 blocks and then 4 more," Ned said, "but how does that tell you that it is 12 blocks?"

"Just watch me number some more blocks on Andy's side of the street and then draw arrows to show how Andy will go to the park. Then you'll catch on."



"I do see. 8 and 4 is 12." Ned was very pleased.

After the story has been discussed, provide each child with a MINNEMAST addition slide rule. The scales may be inserted before the children get them, or the children may help in the preparation. It is suggested that the longer tape be folded into fourths and fastened with masking tape. The shorter, fixed tape may also be taped down.



Let the children play with the slide rules. Give no direct instruction in their use, but discuss the similarity of the slide rule and the story situation with any child who suggests it. There may be children who will now see how to find sums on their slide rules. Lessons 22 and 23 will develop the use of the slide rule for addition.

Lesson 22: ADDING WITH TWO PARALLEL NUMBER LINES

In this lesson the children are shown how to use two parallel number lines to find a sum.

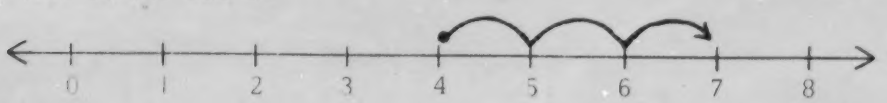
MATERIALS

— colored chalk

— Worksheet 39

PROCEDURE

A. Have a child find the sum 4 + 3 by marking a single number line on the board.



Remind the class that in this marking it was necessary to count the number of unit spaces showing the second addend.

COULD WE USE ANOTHER NUMBER LINE TO COUNT THESE THREE SPACES FOR US?

Draw a pair of number lines with uniform spacings. Have a child number the lower line.

THIS TIME WE WILL USE BOTH OF THESE LINES TO FIND 4 + 3 .

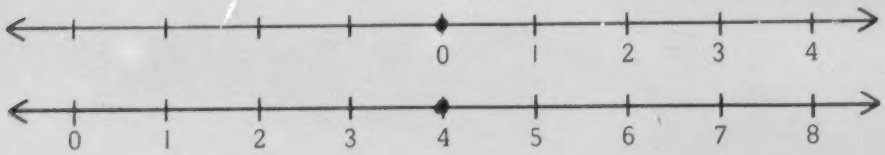
WHAT IS THE FIRST ADDEND? (4)

WILL SOMEONE MARK THE FIRST ADDEND ON THE LOWER LINE? (Colored chalk would be good to use for this.)

WILL SOMEONE MARK THE MATCHING POINT ON THE UPPER LINE?

WE CALL THIS POINT THE 0 OF THE UPPER LINE.

Have a child number the upper number line to 4 or 5 .



WHAT DO WE WANT TO ADD TO 4 ? (3)

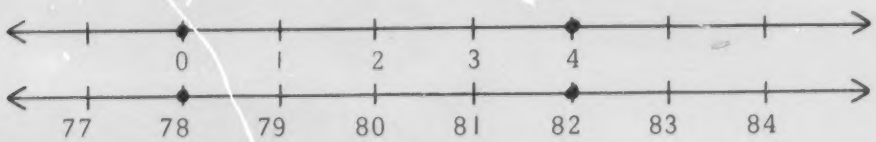
THE UPPER LINE CAN COUNT THE 3 FOR US.

WILL SOMEONE MARK 3 ON THE UPPER LINE?

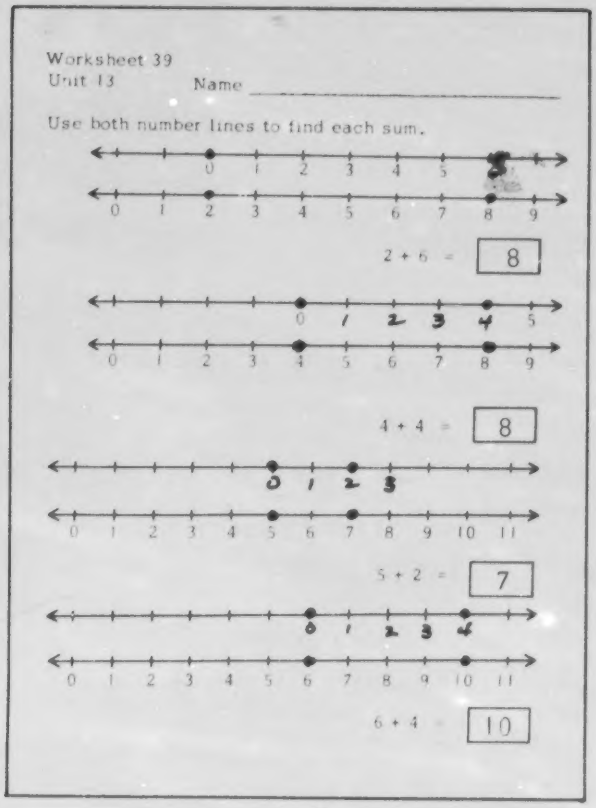
WHERE CAN WE READ THE SUM OF 4 AND 3 ?
(On the lower line, directly under the 3 . It is 7 .)

These questions should lead to markings similar to those shown on the pair of lines below. The children should see the similarity of this diagram to the one in the story. Marking the lines from 0 to 4 and 0 to 3 with differently-colored chalk may show the addends more clearly to some children.

B. Present another example using a larger first addend. You might use 12 + 4 , or if your class understands the method, 78 + 4 .



C. The number lines on Worksheet 39 should be marked in a similar manner.



Worksheet 39
Unit 13 Name _____

Use both number lines to find each sum.

0 1 2 3 4 5 6 7 8 9

2 + 6 = 8

0 1 2 3 4 5 6 7 8 9

4 + 4 = 8

0 1 2 3 4 5 6 7 8 9 10 11

5 + 2 = 7

0 1 2 3 4 5 6 7 8 9 10 11

6 + 4 = 10

Lesson 23: USING THE ADDITION SLIDE RULES

The use of the slide rule is explained to the children here.

MATERIALS

— demonstration addition slide rule

— individual addition slide rules for each child

— Worksheet 40

PROCEDURE

A. Each child should have his addition slide rule. Ask for suggestions for using a slide rule to add 6 and 3 . Some may now be able to see the procedure without further direction. See how much transfer there is from Lesson 22. Part B gives detailed direction for those who need it.

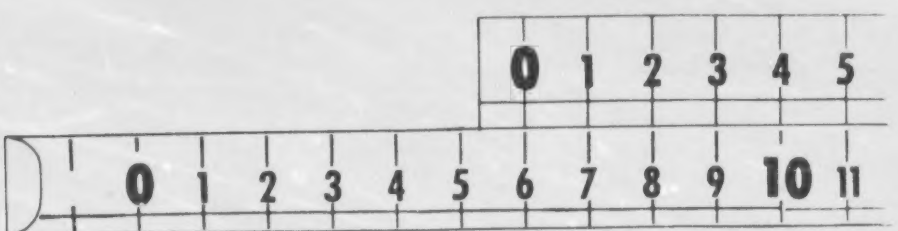
B. Introduce the slide rule as a tool that makes our work easier. Most of the effort in finding the sums on the pairs of number lines in Lesson 22 was the writing of the numerals on the upper line. The slide rule does this job for us.

Show the sum 6 + 3 on the demonstration slide rule while the children follow the procedure with their slide rules.

WE'RE GOING TO ADD 3 TO 6 .

WHERE SHOULD THE 6 OF THE LOWER LINE BE PLACED? (Straight below the 0 on the upper number line.)

WHERE DO WE READ THE SUM? (Straight down from the 3 of the upper number line.)



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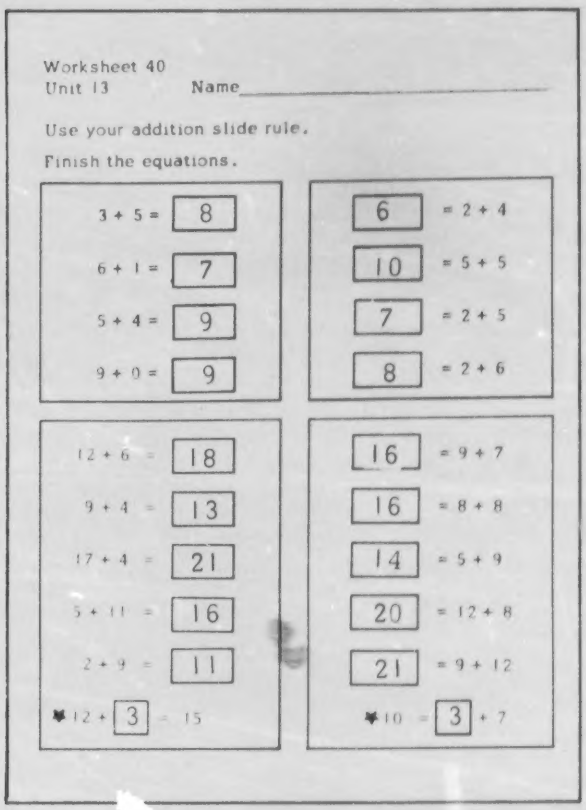
Demonstrate examples until the children are ready to find sums independently. Then have them do Worksheet 40. The two starred problems on the worksheet require the finding of missing addends. Let those who are able complete these problems by using their slide rules, but do not discuss the method with the whole class until Lesson 25.



Worksheet 40
Unit 13 Name_____

Use your addition slide rule.

Finish the equations.

3 + 5 = 8	6 = 2 + 4
6 + 1 = 7	10 = 5 + 5
5 + 4 = 9	7 = 2 + 5
9 + 0 = 9	8 = 2 + 6
12 + 6 = 18	16 = 9 + 7
9 + 4 = 13	16 = 8 + 8
17 + 4 = 21	14 = 5 + 9
5 + 11 = 16	20 = 12 + 8
2 + 9 = 11	21 = 9 + 12
✱12 + 3 = 15	✱10 = 3 + 7

Lesson 24: MORE USE OF THE ADDITION SLIDE RULE

Practice in finding sums with slide rules.

MATERIALS

— demonstration slide rule

— individual slide rules for each child

— Worksheet 41

PROCEDURE

A. Read the following problems aloud. Have each child set the problem up on his slide rule. Then have someone show it on the demonstration slide rule so that all can check their work.

One candy bar costs 6 cents. Another bar costs 7 cents. How many cents do you need to buy both? (13)

Dick has 5 rocks. Tom has 7 rocks. How many do they have altogether? (12) Mary has 8 rocks. How many do Mary, Dick and Tom have altogether? (20)

Sam has 9 crayons in one box and 8 crayons in another box. How many crayons does he have in both boxes? (17)

B. Have the children do Worksheet 41.

Worksheet 41
Unit 13 Name _____

Draw a curve around any two neighbors whose sum is 8.
Happy did one for you.

A	3,	2,	6,	6,	7,	1,	9,	1,	3,	5									
B	0,	9,	8,	0,	1,	7,	4,	4,	6,	0									
C	8,	0,	5,	9,	3,	5,	5,	3,	4,	4									
D	2,	6,	1,	5,	3,	1,	2,	6,	0,	8									

Now look for neighbors whose sum is 5.

E	4,	6,	2,	3,	5,	0	1,	8,	7,	1									
F	0,	1,	4,	6,	2,	3,	0,	5,	1,	2									
G	4,	1,	8,	2,	3	5,	0	7,	6,	1									
H	9,	4,	1	0,	5,	6,	2,	3	4,	1									

Lesson 25: FINDING LARGER SUMS WITH A SLIDE RULE

In this lesson larger sums are found on a slide rule. One addend can be as large as 100 ; the other addend is limited to 12 . Finding these sums on a slide rule involves exactly the same processes as finding the sums of small addends.

MATERIALS

- demonstration slide rule
- individual slide rule for each child
- (optional) two demonstration number line tapes for the board
- Worksheets 42, 43 and 44

PROCEDURE

Have the longer tapes in the individual slide rules unfolded so that addends up to 100 may be used.

A. Read the following problem to the class. Use the demonstration slide rule to show how the addends combine to give the sum. Then the children should set up the problem on their own slide rules.

Bill buys a book for 63 cents. He buys an eraser for 9 cents. How many cents does he spend? (72)

B. Read the problems below to the class. You may wish to write them on the board. Have all the children work the problems on their slide rules and then have one show his solutions on the demonstration slide rule. Have the addition equations written on the board.

Mike had 32 marbles. He is given 6 more marbles. How many marbles does he have? (32 + 6 = 38)

Mr. Bunny hops 27 times. He hops 6 more times. How many hops does he hop altogether? (27 + 6 = 33)

The children may enjoy making up stories to go with combinations such as 88 + 5 , 19 + 11 , and 39 + 12 .

C. (Optional) The children are limited by the design of their slide rules to finding sums with one addend between 0 and 100 and one addend between 0 and 12 . However, you can use demonstration number lines on the board to show sums with two large addends. Mount one number line on the board and move the other number line with respect to it in the same manner as the slide rules are used. A possible addition problem is suggested below.

Ann made 58 cookies for the party. Sally made 43 cookies. How many cookies did they make together? (101)

The blank portion of your demonstration number lines can be marked with larger numbers appropriate to the problems you devise.

D. Have the children solve the "Safari" problems on Worksheets 42, 43 and 44. Be sure the children continue to write addition equations to answer the problems. Children should be encouraged to discuss the pictures on these worksheets.

Worksheet 42
Unit 13 Name _____

Jomo and Tanana lived in Africa. They went on a trip to a place where animals can be watched but must not be hunted.

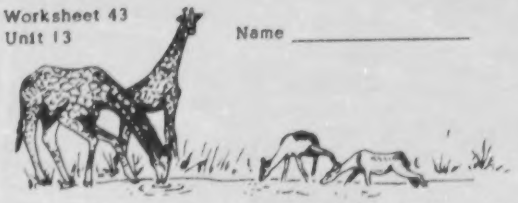
The first day they saw 13 mother monkeys and 13 baby monkeys.
How many monkeys did they see?

13 + 13 = 26

The next day they saw 9 monkeys with bananas.
They saw 12 monkeys without bananas.
How many monkeys did they see that day?

9 + 12 = 21

Worksheet 43
Unit 13 Name _____



Jomo and Tanana went to a waterhole in the African park.
They saw 8 giraffe there.
They also saw 4 antelope.
How many animals did they see at the waterhole?

8 + 4 = 12

They saw 28 zebra and 5 lions in the grass.
How many animals did they see in the grass?

28 + 5 = 33

How many animals did they see at the waterhole and in the grass?

12 + 33 = 45

Worksheet 44A
Unit 13 Name _____

Another day Jomo and Tanana saw 4 rhinos asleep.
They saw 2 rhinos awake.
How many rhinos did they see?

4 + 2 = 6

The children walked to a river.
They saw 16 hippos in the river and 15 hippos on the bank.
How many hippos did they see?

16 + 15 = 31

3 more hippos came to the river.
Now how many hippos were there?

31 + 3 = 34

How many rhinos and hippos did they see altogether?

6 + 34 = 40

Worksheet 44B

Lesson 26: MISSING ADDENDS ON THE SLIDE RULE

Here the children use their slide rules to find the missing addends in problems.

MATERIALS

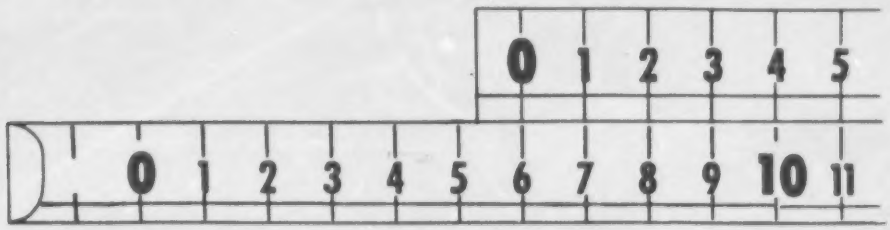
- demonstration slide rule
- individual slide rules
- Worksheets 45, 46 and 47

PROCEDURE

A. Read the following problem to the class.

I have 6 cents. I want 11 cents. How many more cents do I need? (5)

Show the known addend and the sum on the demonstration slide rule. Show how the missing addend can be read from the upper scale.



B. Give your class as many problems similar to the one above as you feel necessary. Then have the class do the problems on Worksheets 45, 46 and 47. The problems are arranged in approximate order of the magnitude of the numbers involved. Although the method to be followed is exactly the same for any numbers, the problems with the greater numbers may be difficult for certain children. Let these children work with the smaller numbers only.

Worksheet 45
Unit 13 Name_____

3 + 6 = 9	5 + 9 = 14
4 + 7 = 11	6 + 9 = 15
9 + 3 = 12	9 + 10 = 19
6 + 4 = 10	2 + 8 = 10
7 + 2 = 9	0 + 11 = 11

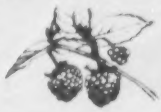
5 + 14 = 19	26 + 8 = 34
4 + 11 = 15	39 + 8 = 47
6 + 9 = 15	59 + 2 = 61
16 + 9 = 25	41 + 9 = 50
26 + 9 = 35	82 + 9 = 91

Worksheet 46
Unit 13 Name _____

Dick needs 28 beets.
Dick has 21 beets.
Dick needs to pull 21 + 7 = 28 beets.

Dick needs 53 potatoes
Dick has 49 potatoes.
Dick needs to dig 49 + 4 = 53 potatoes.

Worksheet 47
Unit 13 Name _____



Tom and Ann want 13 boxes of raspberries.
They have 9 boxes of raspberries.
They need to pick 9 + 4 = 13 boxes of raspberries.

Tom and Ann want 41 boxes of strawberries.
They have 33 boxes of strawberries.
They need to pick 33 + 8 = 41 boxes of strawberries.

Tom and Ann want 21 boxes of grapes.
They have 18 boxes of grapes.
They need to pick 18 + 3 = 21 boxes of grapes.

SECTION 4 ADDITION AND SUBTRACTION PRACTICE

The activities in this section give practice in using addition and subtraction in various situations. Although by now the children will have memorized certain combinations, they should be allowed to use any convenient method to find those they do not recall. Continued practice will make aids (counters, number lines, slide rules or fingers) needed less often, but the children should always have available simple methods of finding sums and differences.

The material in this section is not divided into lessons but is arranged by the type of activity. There are worksheets, group activities, cartoon problems, puzzles and games, all of varying difficulty. The activities may be used in any order you choose. Some of them may be used during the teaching of Sections 5 and 6.

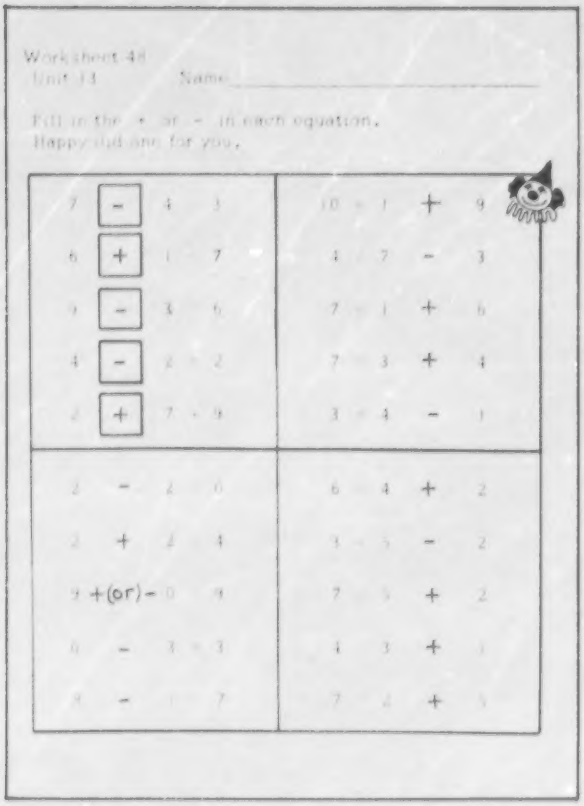
The worksheets in this part review the concepts presented earlier. Some of the worksheets may be completed by children working alone while others are probably more suitable for class activity. Many children will need the directions read and explained to them. Always encourage the children to write complete equations where they are appropriate.

MATERIALS

- counters
- individual number lines
- addition slide rules
- crayons, paste, scissors
- construction paper
- centimeter and inch ruler
- Worksheets 48 - 66

Worksheets 48 and 49 These worksheets call for equations to be completed by inserting + or - signs. This gives practice in distinguishing between addition and subtraction. You may want to introduce the worksheets by having the class as a whole complete equations such as 3 ☐ 2 = 5 and 4 ☐ 1 = 3.

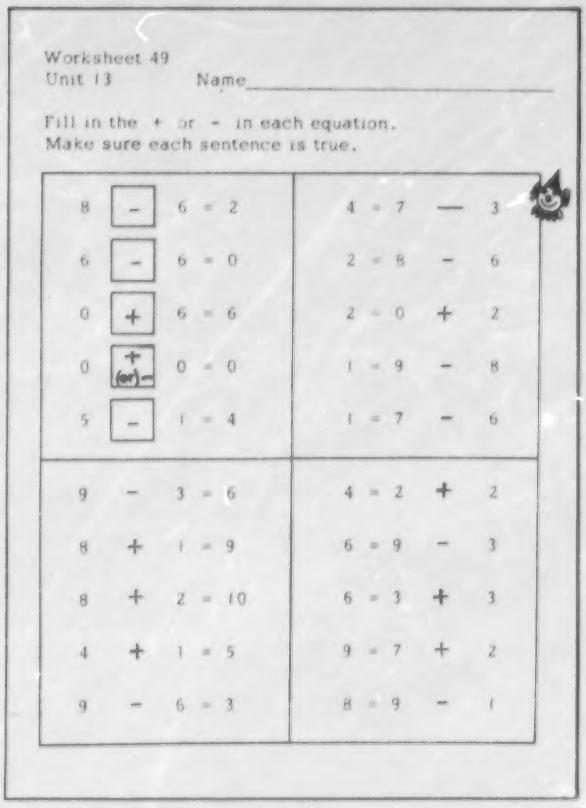
Children who finish the worksheets quickly can continue the activity by working in pairs. The partners can take turns writing similar incomplete equations and filling in the signs.



Worksheet 48
Unit 13 Name_____

Fill in the + or - in each equation.
Happy old one for you.

7	-	4	=	3	10	=	1	+	9
6	+	1	=	7	4	=	7	-	3
9	-	3	=	6	7	=	1	+	6
4	-	2	=	2	7	=	3	+	4
2	+	7	=	9	3	=	4	-	1
2	-	2	=	0	6	=	4	+	2
2	+	2	=	4	3	=	5	-	2
9	+(or)-	0	=	9	7	=	5	+	2
6	-	3	=	3	4	=	3	+	1
8	-	1	=	7	7	=	5	+	3



Worksheet 49
Unit 13 Name_____

Fill in the + or - in each equation.
Make sure each sentence is true.

8	-	6	=	2	4	=	7	—	3
6	-	6	=	0	2	=	8	-	6
0	+	6	=	6	2	=	0	+	2
0	+(or)-	0	=	0	1	=	9	-	8
5	-	1	=	4	1	=	7	-	6
9	-	3	=	6	4	=	2	+	2
8	+	1	=	9	6	=	9	-	3
8	+	2	=	10	6	=	3	+	3
4	+	1	=	5	9	=	7	+	2
9	-	6	=	3	8	=	9	-	1

Worksheet 50
Unit 13 Name _____

Find another name for each space.
Find the color. Color the space.

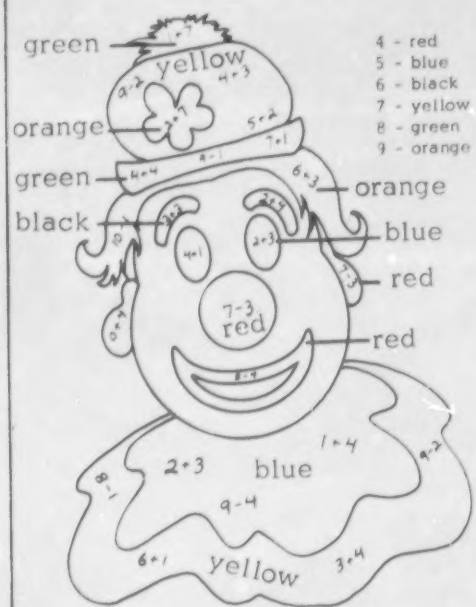
green 8-0	orange 2+3	blue 2+7	yellow 8-2	red 6+1
red 0+7	green 9-1	orange 6-1	blue 1+8	yellow 7-1
yellow 6-0	red 9-2	green 3+5	orange 1+4	blue 9+0
blue 6+3	yellow 4+2	red 2+5	green 0+8	orange 9-4
orange 8-3	blue 5+4	yellow 3+3	red 8-1	green 4+4

5 - orange
6 - yellow
7 - red
8 - green
9 - blue

Worksheets 50, 51 and 52 For these "color-by-number" pictures, the proper colors are determined by finding a number equal to each sum or difference.

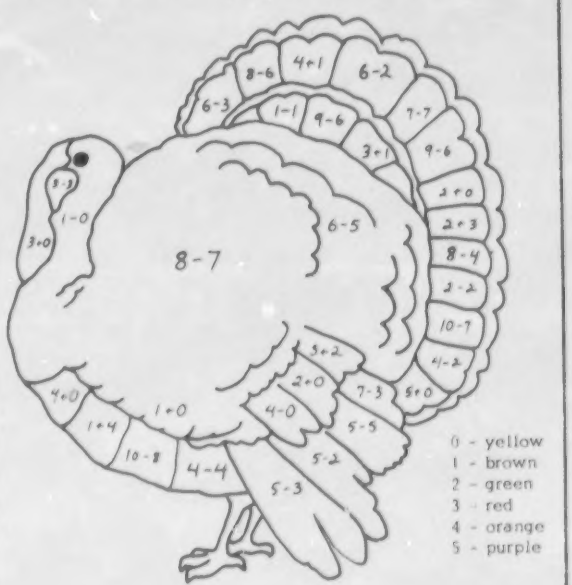
Worksheet 51
Unit 13 Name _____

Find another name for each space.
Find the color. Color the space.



Worksheet 52
Unit 13 Name _____

Find another name for each space.
Find the color. Color the space.



Worksheet 53
Unit 13 Name _____

One morning Jim caught 9 butterflies.
That afternoon Jim caught 4 butterflies.
How many butterflies did he get that day?

9 + 4 = 13

Jim caught moths near a light at night.
One night he caught 17 moths.
The next night he caught 8 moths.
How many moths did he get?

17 + 8 = 25

Jim put his best butterflies and moths in a box.
He put 23 butterflies in the box.
He put 19 moths in the box.
How many more butterflies than moths were in the box?

23 - 19 = 4

Worksheet 54
Unit 13 Name _____

Mike collected beetles.
He had 39 beetles.
He got 6 more beetles.
How many beetles did he have then?

39 + 6 = 45

Mike had 45 beetles.
He gave 7 beetles to his sister.
How many beetles did he have then?

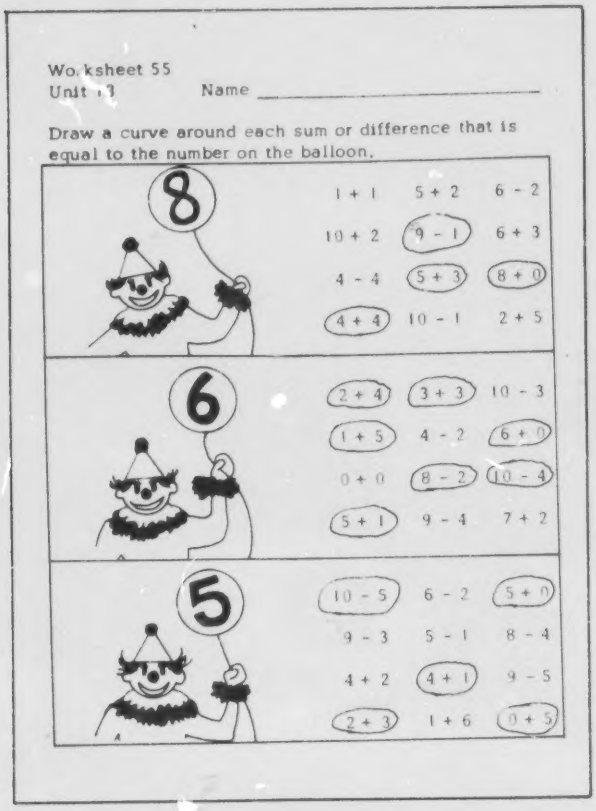
45 - 7 = 38

Fireflies are a kind of beetle.
Mike caught 15 fireflies.
His sister caught 9 fireflies.
How many fireflies did they catch altogether?

15 + 9 = 24

Worksheets 53 and 54 These worksheets ask questions about the numbers of moths, butterflies and beetles collected by children. Interested children may wish to discuss the following bits of information: butterfly antennae are smooth while moth antennae are feathered; anything that comes from a cocoon is a moth and not a butterfly; beetles have hard wing covers; fireflies are beetles.

Worksheet 55 Here the children are asked to locate and mark sums or differences that are equal to a number shown on a clown's balloon.

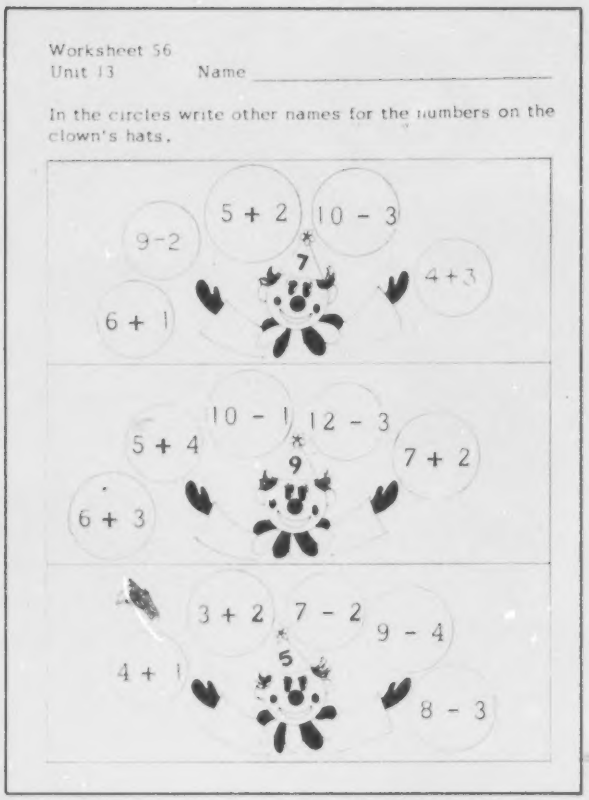

Worksheet 55
Unit 1
Name _____
Draw a curve around each sum or difference that is equal to the number on the balloon.
8
1 + 1 5 + 2 6 - 2
10 + 2 9 - 1 6 + 3
4 - 4 5 + 3 8 + 0
4 + 4 10 - 1 2 + 5
6
2 + 4 3 + 3 10 - 3
1 + 5 4 - 2 6 + 0
0 + 0 8 - 2 10 - 4
5 + 1 9 - 4 7 + 2
5
10 - 5 6 - 2 5 + 0
9 - 3 5 - 1 8 - 4
4 + 2 4 + 1 9 - 5
2 + 3 1 + 6 0 + 5

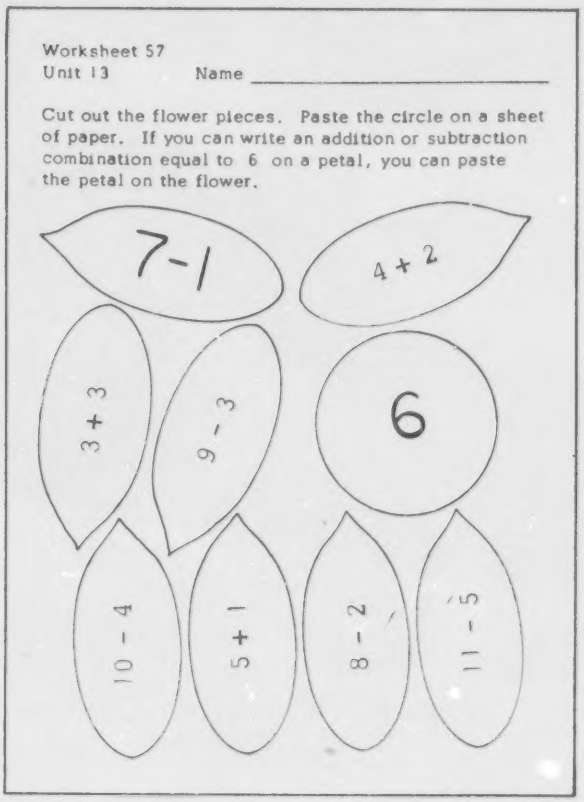
Worksheets 56 and 57 The children are asked to write addition and subtraction combinations that are equal to a given number. This is a somewhat more difficult task than that of Worksheet 55.

On Worksheet 56 combinations equal to the number on the hat are to be written on the circles. On Worksheet 57 the combinations are to be written on daisy petals which are then

pasted around a center to form a flower. One way to use this sheet is to have the forms cut out and the daisy centers pasted on construction paper. Each child should then number his daisy center, either with a given number such as 8 , or with a number he chooses. As he thinks of an addition or subtraction combination equal to his number he writes it on a daisy petal and pastes the petal on his picture.

Some children may be interested in making a bulletin board display similar to one of these worksheets. A numbered daisy center or clown might be pinned up. Then children could put up petals or circles with appropriate number combinations. They might enjoy using longer combinations such as 10 + 2 - 3 + 0 .





Worksheet 58 Aspects of measurement, addition, and subtraction are combined here in the measuring and comparing of various combinations of paper strips. The children should color and cut out the strips. They should then lay the strips on the number line to obtain the answers to the questions. The equations should be completed by filling in the lengths.

Worksheet 58
Unit 13 Name _____

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

1. How long are [yellow] and [green] together?
   7 cm + 6 cm = 13 cm
2. How long are [green] and [red] together?
   6 cm + 3 cm = 9 cm
3. How much longer is [blue] than [green]?
   10 cm - 6 cm = 4 cm
4. How long are [green] [red] and [yellow] together ?
   6 cm + 3 cm + 7 cm = 16 cm
5. How much longer is [yellow] than [red]?
   7 cm - 3 cm = 4 cm

Color these strips. Cut them out.

green

yellow

blue

red

Worksheet 59 The questions on this worksheet concern growth. The answers should be found by marking the vertical number lines.

Worksheet 59
Unit 13 Name _____

Mark the number lines.
Write the equations.

John was 42 inches tall.
He grew 4 inches.
How tall is he now?

42 inches + 4 inches = 46 inches

Bill is 39 inches tall.
Last year he grew 3 inches.
How tall was he a year ago?

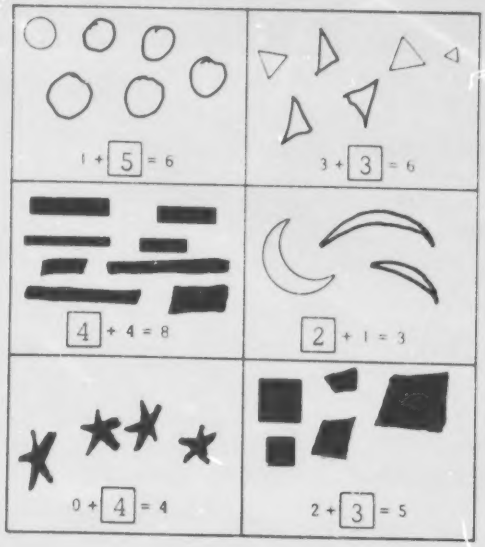
39 inches - 3 inches = 36 inches
or 36 + 3 = 39

Sally's plant is 6 inches tall.
It was 4 inches last week.
How much did it grow during the week?

6 inches - 4 inches = 2 inches
or 4 + 2 = 6

Worksheet 60
Unit 13 Name _____

Finish each picture.
Finish each equation.



Worksheets 60, 61 and 62 These worksheets provide increasingly difficult practice with missing addends and subtrahends. (The term "subtrahend" should not be used with the children.) The addition slide rule is a very good aid to use with Worksheet 61, but the children may use whatever methods they prefer. Some children may not be able to complete Worksheet 62.

Worksheet 61
Unit 13 Name _____

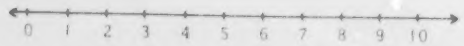
Use your slide rule to finish the equations.

6 + 1 = 7	9 + 0 = 9
6 + 2 = 8	7 + 1 = 8
6 + 0 = 6	7 + 0 = 7
7 + 2 = 9	1 + 2 = 3
4 + 5 = 9	3 + 3 = 6

8 = 2 + 6	8 = 7 + 1
9 = 9 + 0	4 = 0 + 4
7 = 6 + 1	8 = 5 + 3
9 = 2 + 7	7 = 2 + 5
7 = 2 + 5	5 = 4 + 1

Worksheet 62
Unit 13 Name _____

Finish each equation.

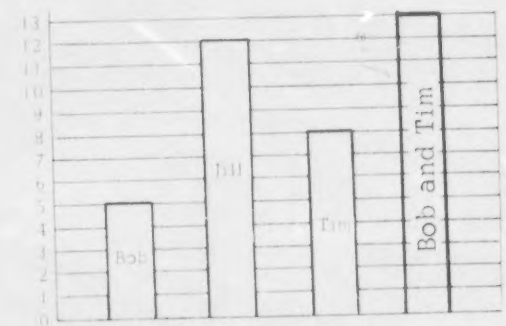


6 - 4 = 2	9 - 2 = 7
5 - 4 = 1	7 - 1 = 6
1 + 2 = 3	5 + 1 = 6
3 + 4 = 7	5 - 3 = 2
6 + 0 = 6	2 + 1 = 3

7 - 6 = 1	6 + 3 = 9
9 + 0 = 9	7 - 2 = 5
2 + 5 = 7	6 + 2 = 8
1 + 7 = 8	7 - 6 = 1
3 + 3 = 6	9 - 3 = 6

Worksheets 63 and 64 The answers to the questions on these worksheets are to be found by reading the graphs on the sheets. You will probably choose to use both worksheets as class activities. An overhead projector may help in your presentation. You may need to review counting by fives before using Worksheet 64, where the scale on the graph is in units of five. In this worksheet, the children may draw the red bar starting at a line other than 0 .

Worksheet 63
Unit 13 Name _____



Bob, Jill and Tim collected large, flat stones.
The graph shows how many stones each child found.

How many did Bob find? 5

How many did Jill find? 12

How many did Tim find? 8

Who had the most? Jill

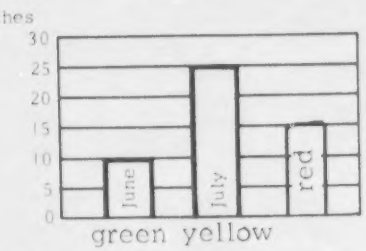
How many more stones did Jill have than Bob? 7

How many fewer stones did Tim have than Jill? 4

Make a new bar on the graph to show how many stones Bob and Tim had together.

Worksheet 64
Unit 13 Name _____

Color the shorter bar green.
Color the longer bar yellow.



A corn plant was measured each month.

The green bar shows that the corn plant was 10 inches tall at the end of June.

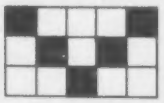
The yellow bar shows that the corn plant was 25 inches tall at the end of July.

How many inches did the corn plant grow between the end of June and the end of July? 15 inches

Make a red bar to show how many inches the corn plant grew in July.

87

Worksheet 65
Unit 13 Name _____



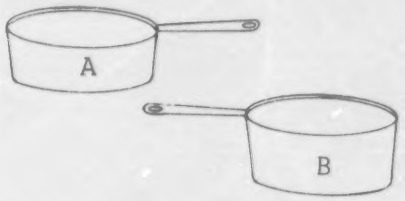
Mary measured the area of a black and white pattern.
The black part was 5 square inches.
The white part was 10 square inches.
The area of the whole pattern was [15] square inches.

From A to B the board is 12 inches long.
From B to C the board is 4 inches long.
The whole board is [16] inches long.

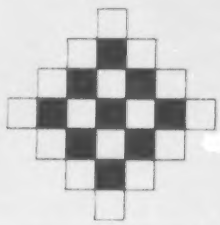
How long would two boards like this be together?

16 + 16 = 32 inches

Worksheet 66
Unit 13 Name _____



Pan A holds 6 cups of water.
Pan B holds 8 cups of water.
Pan A and pan B together hold [14] cups of water.
Pan B holds [2] cups more than pan A.



Jane measured the area of a black and white pattern.
The black part was 9 square inches.
The white part was 16 square inches.
The area of the whole pattern was [25] square inches.

Worksheets 65 and 66 These problems are about measurement. The concepts of area, length, and volume used were developed in Unit 12.

GAMES AND INDIVIDUAL ACTIVITIES

The games and individual activities suggested here can be used now and throughout the remainder of the school year. As the children become familiar with the games, they may wish to modify the given rules to make new games.

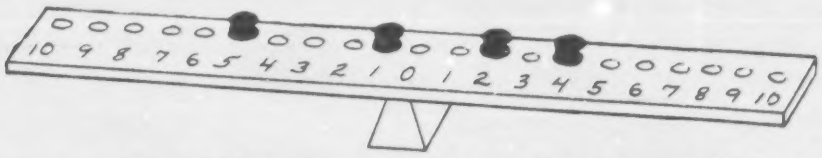
Some of the games and activities can be done by the class together, some are best done by small groups or individual children. Usually the level of difficulty can be readily adjusted to the ability of the participants.

MATERIALS

- addition balance (One such balance is the "Sum Stick," Creative Playthings, Princeton, N. J. 08540 -- #J017, $4.95)
- tagboard cards, about 4" x 10", one for each child
- several sets of tagboard cards, each set made up of 1 card about 8" x 10" and 6 cards about 2" x 2"
- several sets of tagboard cards, each set made up of 1 card about 8" x 10" and 8 circular cards about 1" in diameter

DESCRIPTIONS OF THE GAMES AND ACTIVITIES

Addition With a Balance There are several balances available commercially that provide excellent practice with the properties of addition. Weights are placed on each arm in such a way as to maintain the balance. For example, the sum 5 + 1 = 2 + 4 would be shown on one balance in this way:



When the children play with balances they should be given only the minimum necessary directions.

Number Hunt Game For each child prepare a tagboard card (about 4" x 10") by printing a difference on one side and a sum on the reverse side. The two sides should not be equal and probably should all be in the range 0 to 10; e.g., 6 + 2, 5 - 4; 3 + 0, and 10 - 2. Give each child a card. Say to the class, for example:

I AM GOING ON A NUMBER HUNT FOR 8. IF YOU HAVE A NAME FOR 8, HOLD UP YOUR CARD.

If you wish to have competition, you can divide the class into two teams. The scoring might be 1 point for each wrong answer, with the team with the lower score winning.

Puzzle: Other Names Prepare cards such as the one pictured. Use tagboard, about 8" x 10".

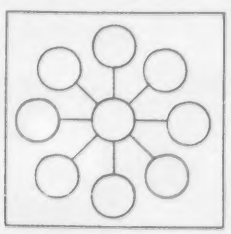
7 - 3	2 + 3
0 + 6	10 - 1
8 - 1	4 - 4

Also prepare smaller numbered cards, about 2" x 2", which will fit into the spaces marked off on the larger card.

The child playing with the puzzle should be told to find a shorter name for the sum or difference in each rectangle and to place the appropriate card in the rectangle.

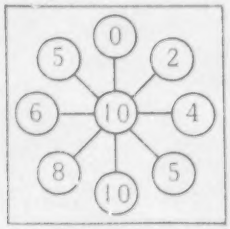
The difficulty of this puzzle is easily varied. Simple or more difficult sums and differences can be used. The number of small cards provided can be just enough for the puzzle or can be greater than needed.

Puzzle: Number Wheel For each puzzle draw the following pattern on a piece of tagboard about 8" x 10". The circles should be about 1" in diameter.



Prepare circular cards to fit on the pattern. One card should be numbered with any number greater than 5 . This card should be colored so it can be identified. The other circular cards should be numbered so that the sums of the numbers on pairs of circles are equal to that on the colored card. For example, for a 6-set you could use 0, 6, 1, 5, 2, 4, 3, 3. A 10-set could include 0, 10, 2, 8, 4, 6, 5, 5 .

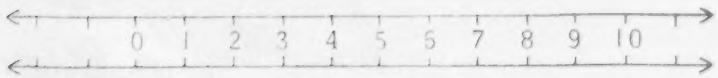
To solve the puzzle a child places the colored card in the center circle. He then places the other cards so that ones in opposite locations add up to the center number. For example:



The difficulty of this puzzle could be increased by providing extra, unnecessary circular cards.

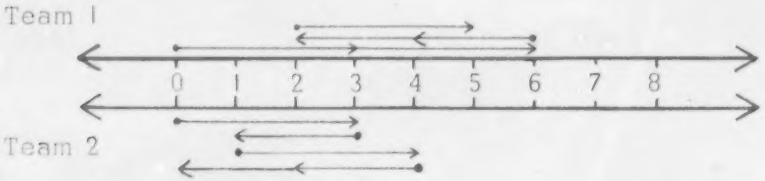
Game: Hit the Target This is a simple game where we start with an object, a series of rules, and a target or goal. The purpose is to reach the target in the least number of steps by applying the rules to the object. A version of the game using a number line is described below.

Divide the players into two teams. Draw two parallel number lines on the board. The lines should extend a few spaces to the left of zero.



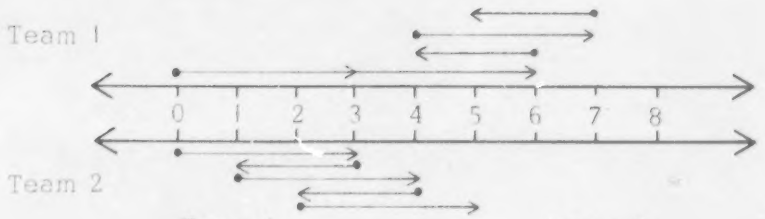
Before starting, the players select one point on the number line to serve as starting point and another to serve as target, and they decide what the possible moves will be, for example, 3 right (written 3R) and 2 left (2L). The teams start at the starting point and take turns making one move at each turn. Each team may choose whichever move it prefers. The purpose is to reach the goal in the fewest possible moves. For the games we have illustrated, 0 was the starting point.

In the first sample game shown here, 5 was the target and Team 1 hit it in fewer moves. (Note that if a team hits the target when the other team has had one turn less, the second team should be given a chance to tie the game.)



Team 1	Team 2
3R (to 3)	3R (to 3)
3R (to 6)	2L (to 1)
2L (to 4)	3R (to 4)
2L (to 2)	2L (to 2)
3R (to 5)	2L (to 0)

A game resulting in a tie is shown here:



Team 1	Team 2
3R (to 3)	3R (to 3)
3R (to 6)	2L (to 1)
2L (to 4)	3R (to 4)
3R (to 7)	2L (to 2)
L (to 5)	3R (to 5)

Of course, the starting point and the target can be changed from game to game. The rules can also be altered. The children should soon realize that some rules will not allow certain targets to be reached, although they should not be expected to explain this. For example, if one starts at 0 , and applies the rules 4R and 2L , it is not possible to hit an odd-numbered target.

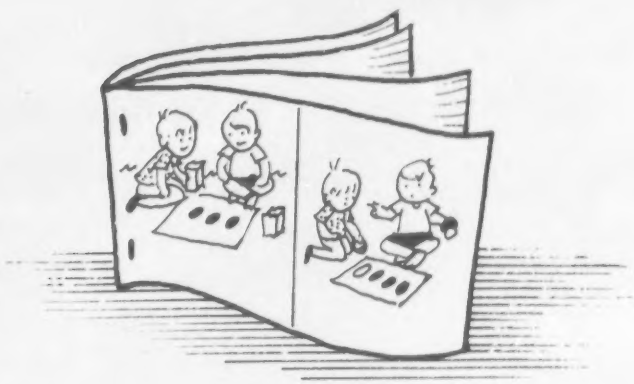
A version of this game could be devised using Minnebars.

CARTOON PROBLEMS

Four story problems have been written and illustrated in cartoon form. Each two frames present a question for the child to answer by an addition or a subtraction equation.

The correct answer is then given in the following frame as a self-evaluation device. This format will allow many children to work the problems independently. Other children will need help in reading the stories.

The problems are printed so that each page can be removed from the student manual, cut horizontally through the middle and fastened together to form a booklet.



One boy has four cookies.

The other boy has three cookies.

How many cookies do they have together?

The boys eat five of the seven cookies.

They put the other cookies in the sack.

How many cookies are in the sack?

The two boys have caught five fish.

They catch two more fish.

How many fish do they now have?

The boys have seven fish.

Four get away.

How many fish are left?

The clown has four balloons.

He lets two go.

How many does he have left?

The clown has two balloons.

He blows up one more.

How many does he now have?

The clown has three balloons.

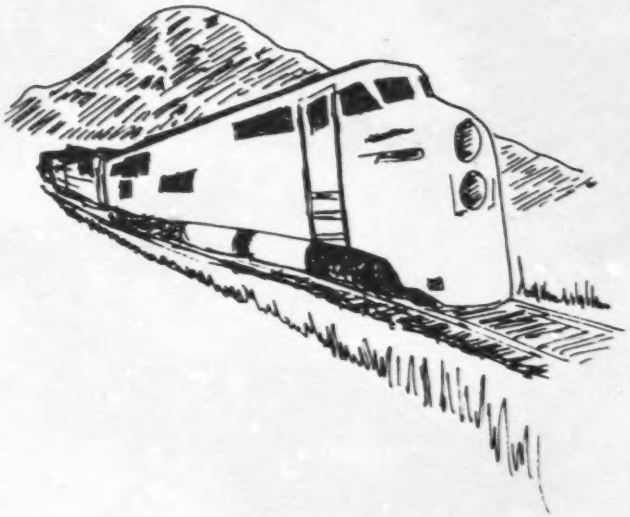
He gives two to the children.

How many does he have left?

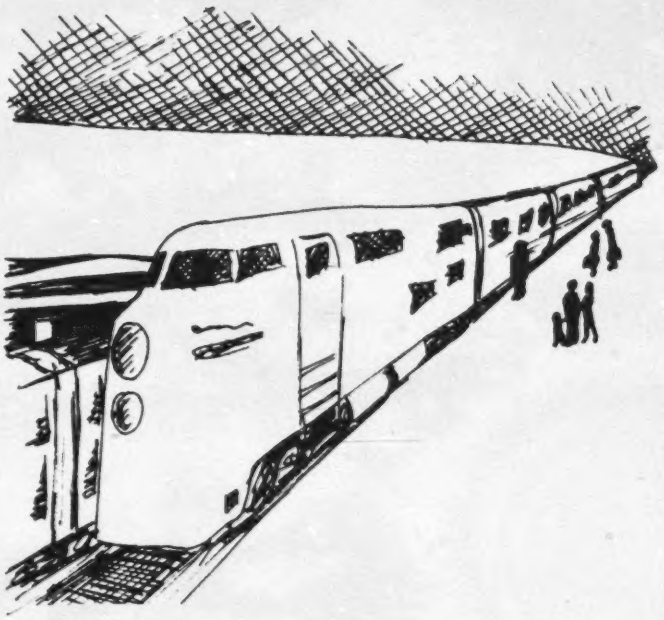
The clown has one balloon.

He gives it to his dog Spot.

How many balloons are left?

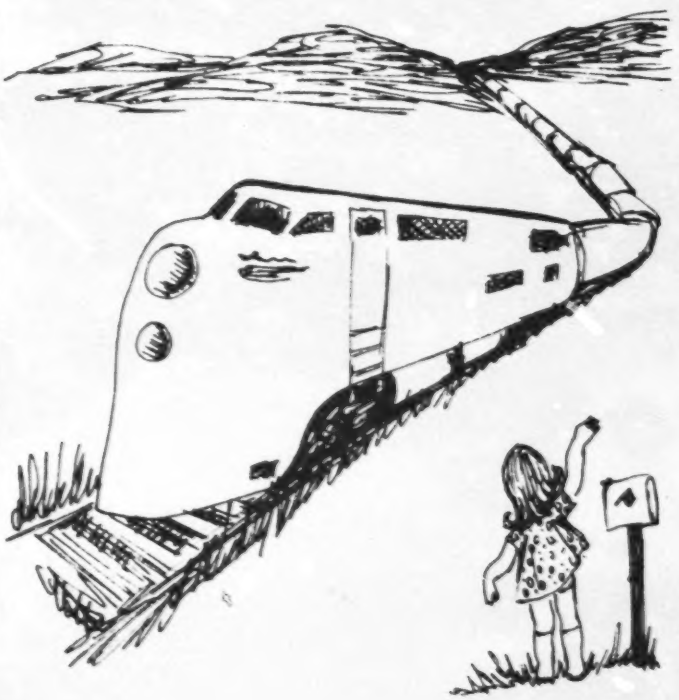


The train left North Town with 27 cars.

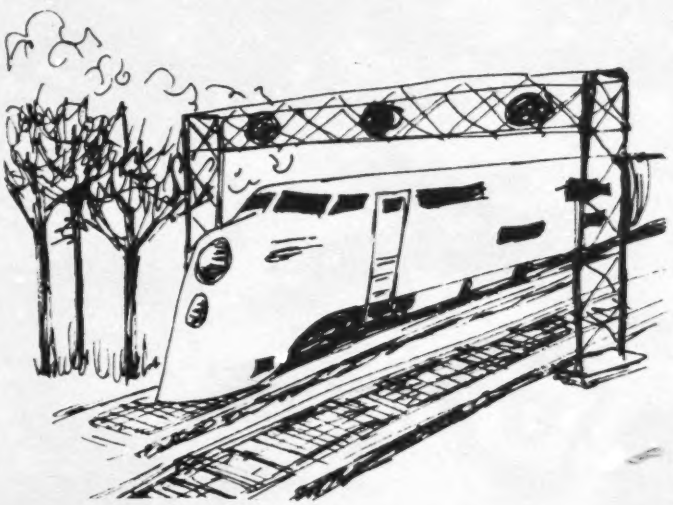


It added 4 cars in Hill City.

How many cars are now in the train?



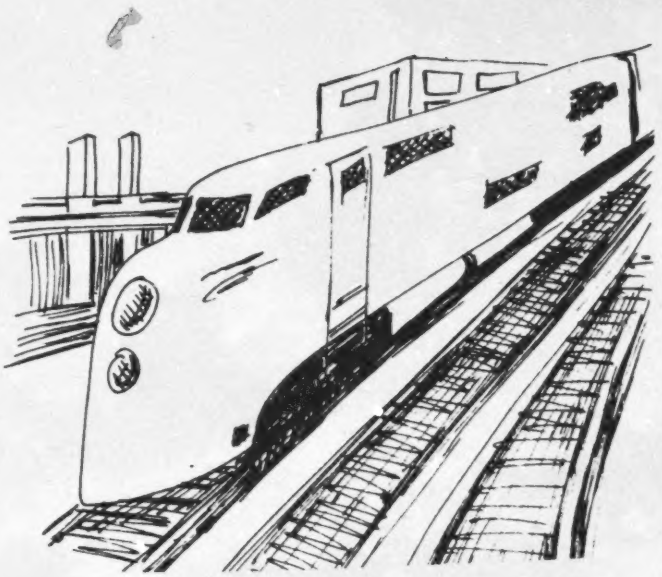
The train left Hill City with 31 cars.



It added 8 cars in River City.

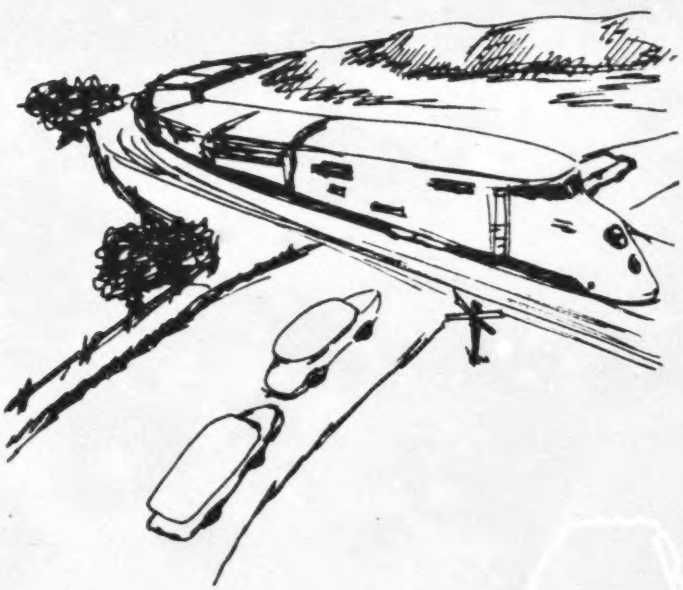
How many cars are now in the train?

The train left River City with 39 cars.

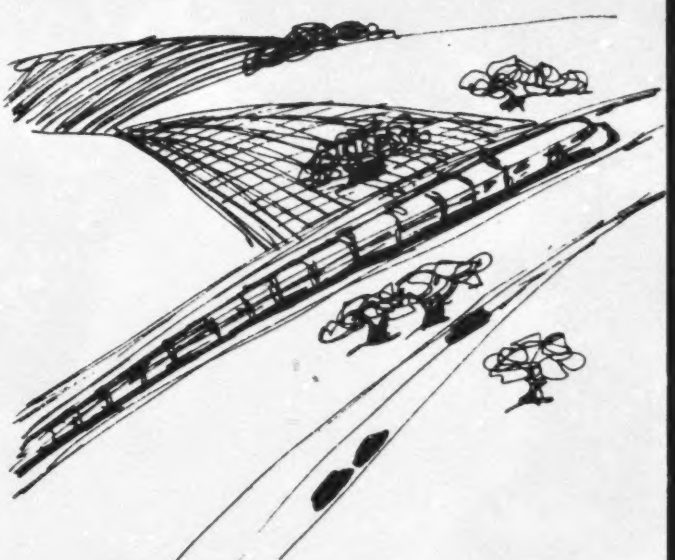


It dropped 7 cars in Lake City.

How many cars are left?



The train left Lake City with 32 cars.



It dropped 32 cars in South Town.

How many cars are left?

SECTION 5 PROPERTIES OF SUMS AND DIFFERENCES

The first two lessons of this section deal with the commutativity (or order principle) of addition and the non-commutativity of subtraction. An example illustrating the commutativity of addition is $5 + 3 = 3 + 5$; an example illustrating the non-commutativity of subtraction is $5 - 3 \neq 3 - 5$. When these lessons are completed a child should be able to apply the principle of commutativity of addition to simple problems such as those on the worksheets. He should realize that the order of the numbers in a subtraction problem does matter, and he should be aware that there are numbers to the left of 0 on the number line. It is not expected that the child will verbalize or name any of these concepts.

The remaining lessons of this section present topics that encourage the children to find patterns, dependencies and relations among numbers. Even a very young child enjoys being given an opportunity to think analytically. He can become genuinely excited over discovering a bit of the structure of science or mathematics.

Of course, this section provides more practice with addition and subtraction skills.

Lesson 27: COMMUTATIVITY OF ADDITION

This lesson presents the basic order principle of addition which says that the sum of two real numbers does not depend on the order of the addends; for example, $5 + 2 = 2 + 5$. This concept is named the commutative principle of addition, but this term will not be used with the children.

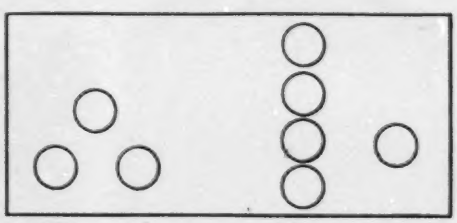
MATERIALS

- flannel board with 8 objects
- Minnebars
- chalk in two colors and white
- Worksheets 67, 68 and 69

PROCEDURE

A. Review the commutativity of addition by joining sets. (This was also done in Unit 11.)

Place a set of 3 objects on one side of the flannelboard and a set of 5 objects on the other side. Point to the sets in turn.



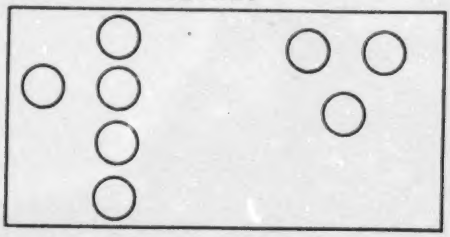
HOW MANY OBJECTS ARE IN THIS SET? (3)

HOW MANY OBJECTS ARE IN THIS SET? (5)

IF WE JOIN THE TWO SETS, HOW MANY ARE IN THE NEW SET? (8)

WHAT EQUATION SHOWS THIS? (3 + 5 = 8)

Turn the flannel board around.



Ask the same questions. This time the resulting equation will be $5 + 3 = 8$.

Conclude the discussion by relating this example to a concrete situation. For example, "I gave Ed 3 pieces of candy and then 5 more. I gave Joe 5 pieces of candy and then 3 more. Did each boy get the same number of pieces?"

B. Minnebars are useful in illustrating the commutativity of addition. Have each child match one long bar with two smaller bars.

WRITE THE EQUATION THAT TELLS ABOUT THE MATCHING BARS. (e.g., $5 + 2 = 7$)

CHANGE THE ORDER OF YOUR SHORTER BARS. DO THEY STILL MATCH THE LONGEST BAR? (Yes.)

WRITE THE EQUATION FOR THIS MATCH. (e.g., $2 + 5 = 7$)

ARE THE SUMS THE SAME? (Yes.)

C. Next present an example that illustrates commutativity on the number line. First draw a number line numbered from 0 to 8 or 9 on the board.

Katie the Kangaroo jumped 4 feet.
After she rested she jumped 3 feet.
How many feet did she jump altogether? $(4 + 3 = 7)$

Joey the Kangaroo jumped 3 feet.
After he rested he jumped 4 feet.
How many feet did he jump altogether? $(3 + 4 = 7)$

Have a child show Katie's jumps with red chalk over the number line and another child show Joey's jumps with blue chalk under the number line.

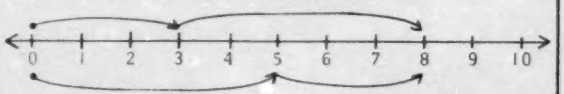
Have a child write the equation $4 + 3 = 3 + 4$ on the board. Point out that both sides of the equation are names for the total number of feet each of the kangaroos jumped. The sum is the same in both cases.

The example may be repeated with variations as often as you wish. You might use problems involving children walking various numbers of blocks, bugs hopping various numbers of inches, or cars driving various numbers of miles.

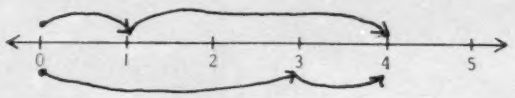
D. Have the children do Worksheets 67, 68 and 69. (Because this lesson is longer than the next you may wish to save Worksheet 69 to use at the end of Lesson 28.)

Worksheet 67
Unit 13 Name _____

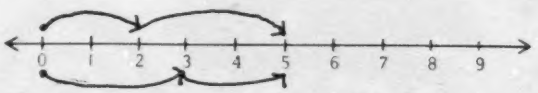
Find the sums.
Mark the addends on the number lines.



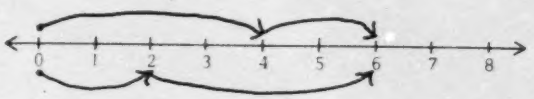
$3 + 5 = \boxed{8}$ $5 + 3 = \boxed{8}$



$1 + 3 = \boxed{4}$ $3 + 1 = \boxed{4}$



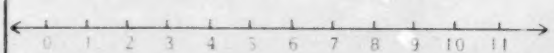
$2 + 3 \quad \boxed{5}$ $3 + 2 = \boxed{5}$



$4 + 2 = \boxed{6}$ $2 + 4 = \boxed{6}$

Worksheet 68
Unit 13 Name _____

Find the sums.
Use the number lines if you need to.

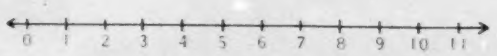


$2 + 5 = 7$ $5 + 2 = 7$	$3 + 6 = 9$ $6 + 3 = 9$
$8 + 2 = 10$ $2 + 8 = 10$	$1 + 10 = 11$ $10 + 1 = 11$
$\begin{array}{r} 7 \\ +\ 3 \\ \hline 10 \end{array}$ $\begin{array}{r} 3 \\ +\ 7 \\ \hline 10 \end{array}$	$\begin{array}{r} 6 \\ +\ 5 \\ \hline 11 \end{array}$ $\begin{array}{r} 5 \\ +\ 6 \\ \hline 11 \end{array}$
$\begin{array}{r} 13 \\ +\ 3 \\ \hline 16 \end{array}$ $\begin{array}{r} 3 \\ +\ 13 \\ \hline 16 \end{array}$	$\begin{array}{r} 12 \\ +\ \frac{1}{2} \\ \hline 12\frac{1}{2} \end{array}$ $\begin{array}{r} \frac{1}{2} \\ +\ 12 \\ \hline 12\frac{1}{2} \end{array}$

Worksheet 69
Unit 13 Name _____

Fill in the boxes.

$2 + \boxed{3} = 5$ $\boxed{3} + \quad = 5$	$1 + \boxed{4} = 5$ $\boxed{4} + 1 = 5$
$9 = 3 + \boxed{6}$ $9 = \boxed{6} + 3$	$8 = 4 + \boxed{4}$ $8 = \boxed{4} + 4$
$0 + \boxed{7} = 7$ $\boxed{7} + 0 = 7$	$7 + \boxed{3} = 10$ $\boxed{3} + 7 = 10$
$2 + 8 = 8 + \boxed{2}$ $5 + 6 = 6 + \boxed{5}$	$8 + 3 = \boxed{3} + 8$ $4 + 7 = 7 + \boxed{4}$



Lesson 28: NON-COMMUTATIVITY OF SUBTRACTION

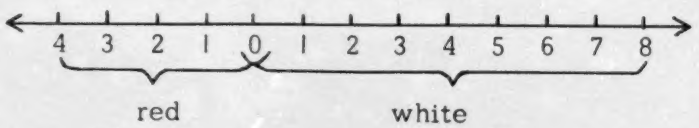
The subtraction operation is not commutative. That is, the order of the numbers does make a difference in subtraction; e.g., $7 - 4 \neq 4 - 7$. Because most children are not ready for worksheets with pairs of problems such as $7 - 4 = 3$ and $4 - 7 = -3$, worksheets will not be provided for this lesson. However, the children do have the background to see from a demonstration on a number line that $7 - 4$ is not the same as $4 - 7$. This is all that need be required from them at present. The existence of numbers to the left of zero is reviewed.

MATERIALS

— red and white chalk

PROCEDURE

Sketch on the board a number line similar to this:



The numerals to the right of zero will be white and to the left of zero, red. Zero should be both red and white. Remind the children that there always are numbers to the left of 0, but that they haven't been using them recently. These numbers are shown by red numerals.

Have a child show $7 - 4 = 3$ on the board by two arrows on the number line. Explain that you would like him to start at 0 and use one arrow to show the move to 7, then another arrow to show the -4 move.

Now ask for a volunteer to use the same method to find the difference $4 - 7$. If he correctly starts at 0 and shows a move of 4 to the right followed by a move of 7 to the left, he will end at a different point on the number line from the child who demonstrated $7 - 4$. This should show the children that $4 - 7$ is not the same as $7 - 4$. You may have the difference recorded on the board. Always use red chalk for numbers less than zero.

Repeat with other differences such as the pair $5 - 2$ and $2 - 5$, and the pair $2 - 1$ and $1 - 2$. In all cases be sure the children realize that the red numeral represents points to the left of zero.

Lesson 29: SMALL ADDITION CHARTS

In earlier lessons the children have used addition in many contexts. They are probably now ready to develop addition charts which show sums in a more abstract manner. Developing the addition charts will give more practice with sums to 20. However, the more important reason for making the charts in this lesson is to provide background for Lesson 30, where a complete 10 x 10 addition chart is developed and used.

We begin with a chart that is not arranged in counting order. We do this because to complete such a chart a child must know the sums and he must know the system by which they are placed on the chart. He cannot fill an out-of-order chart by a simple counting procedure.

MATERIALS

— Worksheets 70 and 71

PROCEDURE

If you introduce addition charts as a type of puzzle you will generate more interest and understanding than if you simply present a series of instructions to be followed. You could start with this chart:

+	1	4
3		
0		

Fill in one of the boxes. Ask if anyone thinks he knows the rule you used to choose the number for the box. If someone sees the rule, have him keep the secret, but have him fill in another box. Repeat this process until the chart is completed. You may need to fill in more than one box before someone sees the rule. Tracing the row of one addend and the column of the other addend to their intersection with your fingers may help some children to see the rule.

After the previous chart is filled, try this one:

+	4	2	3	0
1				
3				
5				

When a few boxes are filled in, discuss the rule with the children. Always read the row first and then the column. For example, the entry in the chart below should be read "3 plus 2 is 5", not "2 plus 3 is 5", even though by the law of commutativity the latter is also true.

+	4	2	3	0
1				
3		5		
5				

A third practice chart can be one without any numerals. The children can take turns in filling in row and column headings and the sums.

Most of your class should now be ready to complete Worksheet 70. Worksheet 71 is more difficult. You may wish to use it for a group activity.

Worksheet 70
Unit 13 Name _____

Complete these addition charts.

+	3	1	5	2
2	5	3	7	4
5	8	6	10	7
1	4	2	6	3
3	6	4	8	5

+	3	1	2
0	3	1	2
4	7	5	6
2	5	3	4

+	4	2
0	4	2
1	5	3
2	6	4
3	7	5
4	8	6
5	9	7

+	5	2
6	11	8
3	8	5

+	0	1	2	3
0	0	1	2	3
1	1	2	3	4
2	2	3	4	5
3	3	4	5	6

Worksheet 71
Unit 13 Name _____

Can you finish these charts?

+	5	0	1
3	8	3	4
2	7	2	3
4	9	4	5

+	3	6	0
5	8	11	5
2	5	8	2
1	4	7	1

+	0	1	2	3	4	5	6	7	8
4	4	5	6	7	8	9	10	11	12
5	5	6	7	8	9	10	11	12	13

+	2	4	4	6
3	5	7	7	9
1	3	5	5	7
4	6	8	8	10
0	2	4	4	6

Lesson 30: A TEN BY TEN ADDITION CHART

The children are asked here to complete an addition chart with all the sums from 0 + 0 to 10 + 10 . This chart will be used to find sums and missing addends in the next lesson. In this lesson the chart will be studied to discover patterns among the sums and addends. This is one of the most important reasons for making the chart.

COMMENTARY

A completed addition chart (0 - 10) looks like this:

+	0	1	2	3	4	5	6	7	8	9	10
0	0	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10	11
2	2	3	4	5	6	7	8	9	10	11	12
3	3	4	5	6	7	8	9	10	11	12	13
4	4	5	6	7	8	9	10	11	12	13	14
5	5	6	7	8	9	10	11	12	13	14	15
6	6	7	8	9	10	11	12	13	14	15	16
7	7	8	9	10	11	12	13	14	15	16	17
8	8	9	10	11	12	13	14	15	16	17	18
9	9	10	11	12	13	14	15	16	17	18	19
10	10	11	12	13	14	15	16	17	18	19	20

There are many interesting patterns on the addition chart. Some of them are discussed below.

1) Addends in Sequence Filling in the addition chart can be a simple procedure. It may be related to the use of the addition slide rule. For example, when you place the 1 of the lower scale directly under the 0 of the upper scale and read across, you find the same sequence of numbers that you can read on the 1-row of the chart.

+	0	1	2	3	4	5	6	7	8	9	10
0											
1	1	2	3	4	5	6	7	8	9	10	11

Similarly the 4-row is what one would read if the 4 of the lower scale were placed under the 0 of the upper scale.

2) Commutativity The sum of two addends will be found at the intersection of the row headed by either addend and the column headed by the other. For example, 1 + 2 = 3 and 2 + 1 = 3 are shown here:

+	0	1	2
0			
1			3
2		3	

3) Symmetry About the Diagonal The entries in the chart are symmetric about the diagonal from the upper left corner.

+	0	1	2	3
0	0	1	2	3
1	1	2	3	4
2	2	3	4	5
3	3	4	5	6

This bilateral or mirror symmetry of the pattern of numerals appears because addition is commutative.

4) Identical Sums on Diagonals Identical sums appear on all the diagonals from the lower left to the upper right.

+	0	1	2	3
0			2	
1		2		
2	2			
3				

If you draw a diagonal through an odd sum, all sums the diagonal passes through will be odd; a similar pattern holds for even-numbered sums.

+	0	1	2	3	4
0		1			
1			3		
2	2			5	
3		4			7
4			6		

There are also patterns in the addition of odd and even numbers:

The sum of two odd numbers is even.

The sum of two even numbers is even.

The sum of an odd and an even number is odd.

MATERIALS

— Worksheet 72

PROCEDURE

Put the following chart on the board. Explain that this time the row and column headings are in counting order to make the chart easier to use.

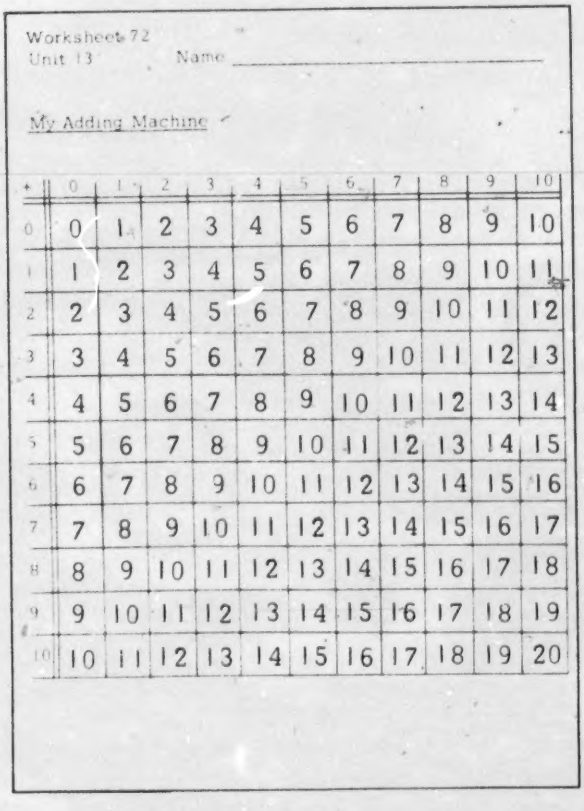
+	0	1	2	3	4	5
0						
1						
2						
3						
4						
5						

Fill in a few boxes. Then ask children to fill in others. They may use their slide rules.

When you feel children are ready to complete a 10 x 10 chart, have them begin working independently on Worksheet 72. The title of the worksheet, "My Adding Machine," often appeals to the children because they can use the chart to find sums easily and quickly.

Encourage the children to notice patterns in the chart as they work. If a child uses the simple counting method to complete the chart, give him your approval, but ask him not to tell the others about it.

After most of the class have completed the chart, discuss some of the patterns discovered. Any pattern noticed by a child is a correct response, whether it is one of the patterns mentioned above or not.



Worksheet 72
Unit 13 Name _____

My Adding Machine

+	0	1	2	3	4	5	6	7	8	9	10
0	0	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10	11
2	2	3	4	5	6	7	8	9	10	11	12
3	3	4	5	6	7	8	9	10	11	12	13
4	4	5	6	7	8	9	10	11	12	13	14
5	5	6	7	8	9	10	11	12	13	14	15
6	6	7	8	9	10	11	12	13	14	15	16
7	7	8	9	10	11	12	13	14	15	16	17
8	8	9	10	11	12	13	14	15	16	17	18
9	9	10	11	12	13	14	15	16	17	18	19
10	10	11	12	13	14	15	16	17	18	19	20

Lesson 31: USING THE ADDITION CHART

This lesson provides practice in using an addition chart to find sums and missing addends.

MATERIALS

— Worksheets 73 and 74

PROCEDURE

Have the children use their completed addition charts to find the sums on Worksheet 73 and the missing addends on Worksheet 74. To locate a missing addend, one finds the appropriate row, moves across to the given sum, and moves up to the missing addend. The following diagram shows the moves in solving $3 + \square = 5$.

+	0	1	(2)	3	4
0	0	1	2	3	4
1	1	2	3	4	5
2	2	3	4	5	6
(3)	3	4	(5)	6	7
4	4	5	6	7	8

Worksheet 73
Unit 13 Name _____

Use your addition chart to finish the equations.

4 + 7 = 11 4 + 8 = 12 4 + 9 = 13 4 + 10 = 14 4 + 11 = 15	3 + 7 = 10 5 + 8 = 13 9 + 7 = 16 4 + 6 = 10 6 + 8 = 14
$\begin{array}{r} 5 \\ +5 \\ \hline 10 \end{array}$ $\begin{array}{r} 6 \\ +3 \\ \hline 9 \end{array}$ $\begin{array}{r} 10 \\ +9 \\ \hline 19 \end{array}$ $\begin{array}{r} 8 \\ +8 \\ \hline 16 \end{array}$	$\begin{array}{r} 7 \\ +8 \\ \hline 15 \end{array}$ $\begin{array}{r} 9 \\ +8 \\ \hline 17 \end{array}$ $\begin{array}{r} 4 \\ +0 \\ \hline 4 \end{array}$ $\begin{array}{r} 5 \\ +9 \\ \hline 14 \end{array}$

Worksheet 74
Unit 13 Name _____

Use your addition chart to finish the equations.

5 + 3 = 8 6 + 3 = 9 8 + 3 = 11 7 + 3 = 10 4 + 3 = 7	3 + 0 = 3 6 + 5 = 11 4 + 6 = 10 9 + 9 = 18 8 + 2 = 10
$\begin{array}{r} 5 \\ +7 \\ \hline 12 \end{array}$ $\begin{array}{r} 6 \\ +9 \\ \hline 15 \end{array}$ $\begin{array}{r} 7 \\ +2 \\ \hline 9 \end{array}$ $\begin{array}{r} 7 \\ +4 \\ \hline 11 \end{array}$	$\begin{array}{r} 8 \\ +9 \\ \hline 17 \end{array}$ $\begin{array}{r} 9 \\ +10 \\ \hline 19 \end{array}$ $\begin{array}{r} 7 \\ +6 \\ \hline 13 \end{array}$ $\begin{array}{r} 8 \\ +9 \\ \hline 17 \end{array}$

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Lesson 32: FINDING THE RULE (ADDITION)

In this lesson the children are to determine the operation used in going from one number to another. This gives more practice in finding missing addends. It also provides background for mapping and function, concepts that will be developed in later years.

MATERIALS

— demonstration slide rule

-- Minnebars

— Worksheet 75

PROCEDURE

A. Write $3 \longrightarrow 5$ on the chalkboard.

HOW DID I GET FROM 3 TO 5 ? (You added 2 to 3 .)

WE WILL WRITE THE RULE OVER THE ARROW LIKE THIS:

$$3 \xrightarrow{+2} 5$$

USE THE SAME RULE TO FINISH THESE:

$$4 \xrightarrow{+2}$$

$$1 \xrightarrow{+2}$$

$$5 \longrightarrow 7$$

Have the children write the completed series on paper. Then ask for volunteers to complete the series on the board.

Show with the demonstration slide rule that these pairs of numbers can be read from a pair of number lines when one has been moved 2 units to the right of the other. This illustrates that moving one of the number lines 2 units to the right of the other corresponds to adding 2 to each number.

B. Write the following series of number pairs on the board.

2 ⟶ 5

3 ⟶ 6

6 ⟶ 9

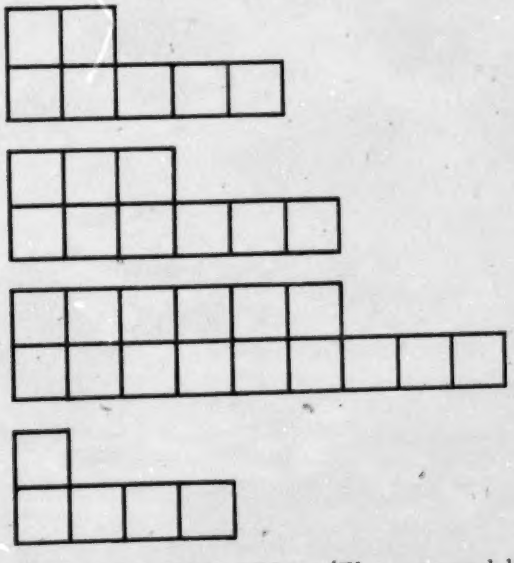
1 ⟶ 4

Tell the children that in every pair you used the same rule to go from the first number to the second number.

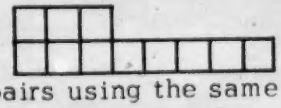
WHAT RULE DID I USE? (+3)

Have the children write +3 over each arrow in the series.

It is helpful for children to see this relation shown by Minnebars. Ask them to arrange their Minnebars to show the pairs in the series on the board.



WHAT PATTERN DO YOU SEE? (The second bar in each pair is 3 units longer than the first bar.)

C. Show the class a pair of Minnebars, e.g.,  Ask them to arrange some of their bars in pairs using the same rule that this pair illustrates. The children can take turns in writing on the board the number pairs shown by their bars.

D. Worksheet 75 has more series of this type. Have the children complete these series.

Worksheet 75
Unit 13 Name _____

Each group has a rule.
Write the rule over the arrows.
Write the missing numbers.

6 $\xrightarrow{+3}$ 9	1 $\xrightarrow{+5}$ 6
0 $\xrightarrow{+3}$ 3	2 $\xrightarrow{+5}$ 7
4 $\xrightarrow{+3}$ 7	3 $\xrightarrow{+5}$ 8
5 $\xrightarrow{+3}$ 8	4 $\xrightarrow{+5}$ 9
19 $\xrightarrow{+2}$ 21	10 $\xrightarrow{+1}$ 11
20 $\xrightarrow{+2}$ 22	[illegible] $\xrightarrow{+1}$ 9
21 $\xrightarrow{+2}$ 23	5 $\xrightarrow{+1}$ 6
22 $\xrightarrow{+2}$ 24	7 $\xrightarrow{+1}$ 8

Lesson 33: FINDING THE RULE (ADDITION AND SUBTRACTION)

This lesson is an extension of Lesson 32. Again the children will determine the operation used to go from one number in a pair to the other. Both addition and subtraction will be used.

MATERIALS

— demonstration number line

— Worksheets 76 and 77

PROCEDURE

A. Write the following series on the board:

$4 \longrightarrow 2$

$5 \longrightarrow 3$

$2 \longrightarrow 0$

$7 \longrightarrow$

Explain again that the same rule was used to go from each number on the left to the number on the right. Ask for volunteers to fill in the rule $\xrightarrow{-2}$ and the missing number.

Show the pairs of numbers on the demonstration number line. The second number of each pair in the series is 2 units to the left of the first number.

Use as many other examples with a subtraction rule as you wish before having the class complete Worksheet 76.

Worksheet 76
Unit 13 Name _____

Find the rule for each group.
Write the missing numbers.

$6 \xrightarrow{-1} 5$	$5 \xrightarrow{-2} 3$
$4 \xrightarrow{-1} 3$	$4 \xrightarrow{-2} 2$
$7 \xrightarrow{-1} 6$	$3 \xrightarrow{-2} 1$
$9 \xrightarrow{-1} 8$	$2 \xrightarrow{-2} 0$
$8 \xrightarrow{-3} 5$	$5 \xrightarrow{-5} 0$
$7 \xrightarrow{-3} 4$	$7 \xrightarrow{-5} 2$
$6 \xrightarrow{-3} 3$	$9 \xrightarrow{-5} 4$
$5 \xrightarrow{-3} 2$	$6 \xrightarrow{-5} 1$

B. Introduce Worksheet 77 by having the class consider several series of number pairs for which the appropriate rule might be either addition or subtraction. Be certain that the children realize that just one rule is used for each series of number pairs. Some suggested pairs are:

$6 \longrightarrow 3$	$7 \longrightarrow 3$	$\xrightarrow{+6} 7$
$3 \longrightarrow 0$	$4 \longrightarrow 0$	$\xrightarrow{+6} 6$
$4 \longrightarrow 1$	$5 \longrightarrow$	$\longrightarrow 9$
$5 \longrightarrow$	$\longrightarrow 6$	$\longrightarrow 8$

Worksheet 77
Unit 13 Name _____

Find the rule for each group.
Write the missing numbers.

$2 \xrightarrow{+4} 6$ $1 \xrightarrow{+4} 5$ $3 \xrightarrow{+4} 7$ $5 \xrightarrow{+4} 9$	$4 \xrightarrow{+4} 8$ $3 \xrightarrow{+4} 7$ $3 \xrightarrow{+4} 7$ $5 \xrightarrow{+4} 9$
$18 \xrightarrow{-2} 16$ $11 \xrightarrow{-2} 9$ $7 \xrightarrow{-2} 5$ $13 \xrightarrow{-2} 11$	$11 \xrightarrow{+7} 18$ $7 \xrightarrow{+7} 14$ $5 \xrightarrow{+7} 12$ $0 \xrightarrow{+7} 7$

SECTION 6 ADDING AND SUBTRACTING TWO-DIGIT NUMBERS

(OPTIONAL)

This section reviews the decimal place value notation and introduces the method commonly used to add and subtract multidigit numbers. Only one- and two-digit numbers will be considered, and no renaming of 1's to 10's (carrying) or of 10's to 1's (borrowing) will be required. The material in this section will be presented again in second grade; therefore, feel free to use only those activities which are suited for your class and for which you have time.

COMMENTARY

The justification of finding $50 + 40$ by "adding 0 and 0 and 5 and 4" is that

$$50 + 40 = (5 \times 10) + (4 \times 10) = (4 + 5) \times 10 = 9 \times 10 = 90$$

These steps involve basic principles of multiplication with which the children are not familiar. To avoid the direct use of multiplication we will develop the idea of adding multiples of ten by working with sets of ten. Thus, in these lessons the children will be led to think of $50 + 40$ as 5 tens plus 4 tens.

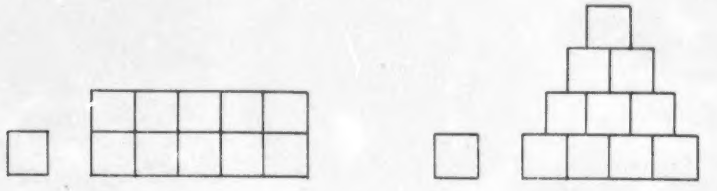
We will also use a set interpretation to introduce more complex problems, such as $54 - 31$. The justification of the common computational method for finding $54 - 31$ would involve the following steps, which of course should not be presented to first graders.

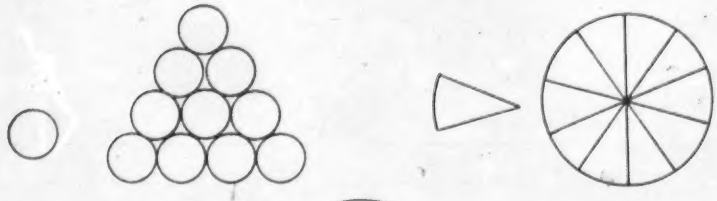
$$\begin{aligned} 54 - 31 &= [(5 \times 10) + 4] - [(3 \times 10) + 1] \\ &= [(5 \times 10) - (3 \times 10)] + [4 - 1] \\ &= [(5 - 3) \times 10] + 3 \\ &= (2 \times 10) + 3 \\ &= 23 \end{aligned}$$

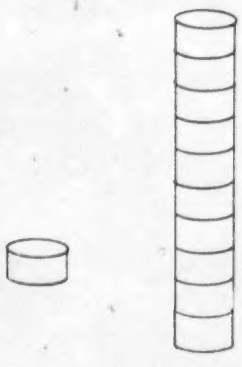
NOTES ON THE TEACHING OF THIS SECTION

Each lesson starts with a demonstration on the board and on an abacus. It is likely that some children will benefit by repeating the demonstrated examples with their own counters.

The demonstrations call for "sets of one " and "sets of ten." The set of one is a single unit shape, and the set of ten is formed by joining ten unit shapes in an easily recognized form. They can be made of heavy paper or tagboard and placed on a blackboard with sticky putty or on a flannel board. Some shapes that might be used are sketched below.







Nine unit shapes and up to nine of the larger shapes should be prepared in each of the designs selected.

Lesson 34: PLACE VALUE NOTATION

This lesson reviews decimal place value notation. A transition is made from the word "and" to the symbol + in expressing numbers in terms of sets of tens and ones. If a child has much difficulty with this lesson he should review the treatment of place value in Unit 11.

MATERIALS

— paper sets of one and sets of ten

— abacus

— Worksheets 78 and 79

PROCEDURE

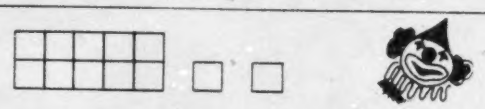
Place 2 sets of ten and 4 sets of one on the board. Guide a discussion in which the children note that these are three names for the number of unit shapes displayed:

2 tens and 4 ones	20 + 4	24

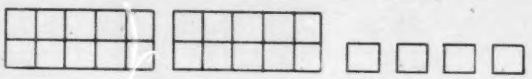
With the 24 shapes still on the board have 24 set up on the abacus. Repeat the process with various numbers until you feel the class is ready for Worksheets 78 and 79.

Worksheet 78
Unit 13 Name _____

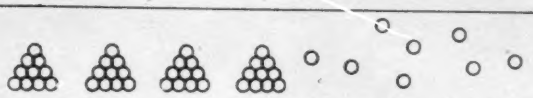
Write names for the total number of unit shapes.



1 tens and 2 ones 10 + 2 = 12



2 tens and 4 ones 20 + 4 = 24



4 tens and 8 ones 40 + 8 = 48

7 tens and 0 ones 70 + 0 = 70

Worksheet 79
Unit 13 Name _____

Write three names for each number.

27	2 tens and 7 ones	20 + 7
56	5 tens and 6 ones	50 + 6
13	1 tens and 3 ones	10 + 3
30	3 tens and 0 ones	30 + 0
42	4 tens and 2 ones	40 + 2
70	7 tens and 0 ones	70 + 0
81	8 tens and 1 ones	80 + 1
99	9 tens and 9 ones	90 + 9
39	3 tens and 9 ones	30 + 9
73	7 tens and 3 ones	70 + 3
60	6 tens and 0 ones	60 + 0
45	4 tens and 5 ones	40 + 5

Lesson 35: SUMS AND DIFFERENCES OF ONE-DIGIT AND TWO-DIGIT NUMBERS

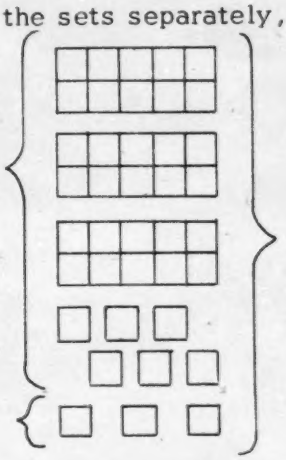
In this lesson a one-digit number is added to or subtracted from a two-digit number by adding or subtracting the one-digit number from the number in the ones place of the two-digit number.

MATERIALS

- paper sets of one and sets of ten
- abacus
- about ten 3" x 5" cards printed with combinations such as 36 + 3 , 48 + 1 , 26 + 3 , 11 + 7 , 54 + 5 , 93 - 2 , 74 - 3 , 88 - 6 , 17 - 7 , 46 - 0
- Worksheets 80, 81 and 82

PROCEDURE

A. Use your paper sets to demonstrate the following problem. First consider the sets separately, then join them.



With the above problem still displayed, have someone set up 36 on the abacus and then add 3 to it.

Repeat the activity with other sums and differences not requiring regrouping (carrying or borrowing).

B. Individual practice in finding sums and differences on the abacus is appropriate here. When you think it will be helpful, provide a child with an abacus and problem cards.

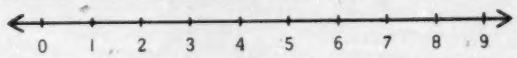
C. Worksheets 80 and 81 contain problems similar to those of A and B in a vertical form. You may wish to do one or two problems as a class activity and use the rest for individual practice. Worksheet 82 allows the children to apply the methods of the lesson to word problems.

NOTE: Worksheet 82 shows a seacow or Manatee eating a water hyacinth. These aquatic mammals live along seacoasts and up river inlets.

Worksheet 80
Unit 13 **Name** _____

Find the sums. Use the number line if you need it.

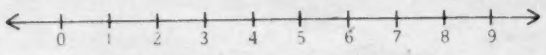
30 + 6 + 3 30 + 9	36 + 3 39	50 + 1 + 4 50 + 5	51 + 4 55
80 + 4 + 3 80 + 7	84 + 3 87	90 + 4 + 2 90 + 6	94 + 2 96
60 + 5 + 4 60 + 9	65 + 4 69	60 + 6 + 1 60 + 7	66 + 1 67
50 + 0 + 3 50 + 3	50 + 3 53	30 + 2 + 6 30 + 8	32 + 6 38



Worksheet 81
Unit 13 **Name** _____

Find the sums. Use the number line if you need it.

11 + 3 14	25 + 3 28	91 + 8 99	48 + 4 52
62 + 2 64	18 + 1 19	21 + 6 27	72 + 5 77
53 + 0 53	37 + 2 39	12 + 6 18	82 + 3 85
95 + 2 97	24 + 4 28	53 + 3 56	12 + 7 19



Worksheet 82
Unit 13 **Name** _____

Tony and Sal looked at a seacow in a river.
They saw it eat 15 plants.
Then they saw it eat 4 more plants.
How many plants did they see it eat?

15 + 4 = 19

There were 89 plants on the other side of the river.
Another seacow ate 7 of them.
How many plants were left?

89 - 7 = 82

After this seacow ate the 7 plants it ate 12 more.
How many plants did it eat?

7 + 12 = 19

Lesson 36: ADDING AND SUBTRACTING MULTIPLES OF TEN

Here the combining and removing of sets of ten illustrate the addition and subtraction of multiples of ten.

MATERIALS

— paper sets of ten

— abacus

— Worksheet 83

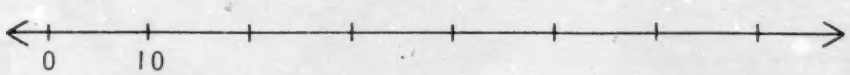
PROCEDURE

A. Have sets of 3 tens and 2 tens placed on the board. Have someone join them and write the following sentences:

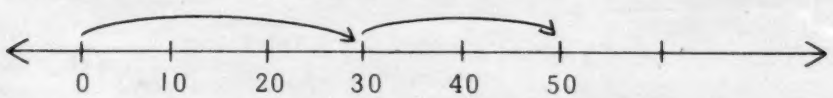
3 tens and 2 tens are 5 tens

30 + 20 = 50

Sketch a number line similar to this:



Have the children place more numerals on the line. (You may need to review counting by tens.) Have someone mark arrows on the line to show $30 + 20 = 50$.



Repeat this procedure with a difference, such as $60 - 30$, and a missing addend problem, such as $50 + \square = 80$.

B. Have a child show the sum $50 + 40$ on the abacus. Then have $90 - 40$ shown.

C. Provide oral practice with combinations of multiples of tens. Each child may use an abacus, a number line marked at the 10's, or sets of ten as aids if he needs them.

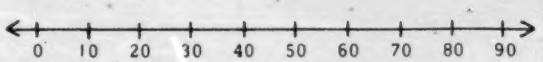
D. Have the children complete Worksheet 83. If a child has difficulty understanding or completing the worksheet, he should have more practice before going on.

Worksheet 83
Unit 13 Name _____

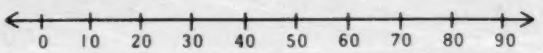
50 + 20 = 70 0 + 50 = 50

60 + 30 = 90 20 + 70 = 90

40 + 10 = 50 30 + 30 = 60



50	30	80
+ 40	+ 20	+ 10
90	50	90
60	50	20
+ 10	+ 0	+ 60
70	50	80



Lesson 37: MONEY PROBLEMS

In this lesson problems involving dimes and pennies are considered. These provide practice with the decimal system of numeration, in adding or subtracting a two-digit and a one-digit number, and in adding or subtracting multiples of ten.

MATERIALS

— play pennies and dimes (optional)

— Worksheets 84 and 85

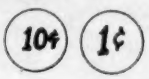
PROCEDURE

Read and find answers to the problems on Worksheets 84 and 85 as a group. Explain that 1 dime is worth 10 cents and that 1 penny is the same as 1 cent.

Play money may be used to help those who have trouble with the problems.

Worksheet 84
Unit 13 Name _____

Jane had 5 dimes.
Mother gave her 2 more dimes.
How many cents did she have?



50 + 20 = 70

Dick had 7 dimes.
He lost 1 dime.
How many cents did he have left?

70 - 10 = 60

Sam gave 3 dimes to Bill and 5 dimes to Tom.
How many cents did he give away?

30 + 50 = 80

John had 5 dimes.
His father gave him 2 dimes and 6 pennies.
How many cents did he have then?

$$\begin{array}{r} 50 \\ +\ 20 + 6 \\ \hline 70 + 6 \end{array} \quad \text{or} \quad \begin{array}{r} 50 \\ +\ 26 \\ \hline 76 \end{array}$$

Worksheet 85
Unit 13 Name _____

Sally had 3 dimes and 2 pennies.
Dick gave her 5 pennies.
She wants a book that costs 35 cents.
Does she have enough money now to buy it? (Yes)

$$\begin{array}{r} 30 + 2 \\ +\quad 5 \\ \hline 30 + 7 \end{array} \quad \text{or} \quad \begin{array}{r} 32 \\ +\ 5 \\ \hline 37 \end{array}$$

Mary has 4 dimes and 9 pennies.
She buys gum for 5 cents.
How much money does she have left?

$$\begin{array}{r} 40 + 9 \\ -\quad 5 \\ \hline 40 + 4 \end{array} \quad \text{or} \quad \begin{array}{r} 49 \\ -\ 5 \\ \hline 44 \end{array}$$

Mike has 50 cents.
He earns 4 dimes.
Now how many cents does he have?

$$\begin{array}{r} 50 \\ +\ 40 \\ \hline 90 \end{array}$$

Tony spent 32 cents.
How many dimes and pennies did he spend?

3 dimes and 2 pennies

Lesson 38: ADDING AND SUBTRACTING TWO-DIGIT NUMBERS

Two-digit numbers are added and subtracted in this lesson. The numbers are so chosen that no renaming of ones to tens or tens to ones is required.

MATERIALS

— paper sets of one and sets of ten

— abacus

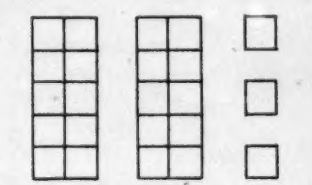
— Worksheets 86 and 87

PROCEDURE

A. Use the paper sets to demonstrate the following sum and as many others as you wish. After an example has been shown on the board, it should also be shown on an abacus.

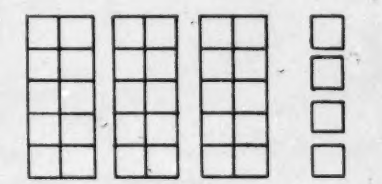
2 tens and 3 ones

20 + 3 = 23



3 tens and 4 ones

30 + 4 = 34



(2 tens + 3 tens) and (3 ones + 4 ones)

= (2 + 3) tens and (3 + 4) ones

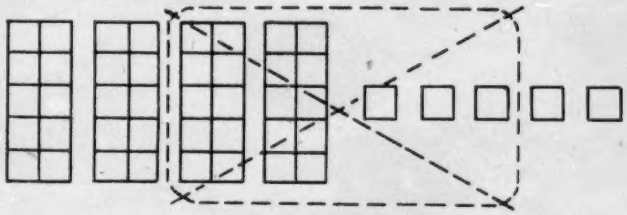
= 5 tens and 7 ones

= 50 + 7

= 57

131

B. The following illustration demonstrates subtraction:



Starting set contains

4 tens and 5 ones or $40 + 5 = 45$

Removed set contains

2 tens and 3 ones or $20 + 3 = 23$

Remaining set contains

(4 - 2) tens and (5 - 3) ones or 2 tens and 2 ones

$(40 - 20) + (5 - 3) = 20 + 2 = 22$

C. Have the class suggest a way to add 36 and 21 using neither the number line nor sets with 36 and 21 members. Guide them to the idea of renaming 36 and 21 as $30 + 6$ and $20 + 1$. Then the ones and tens can be added separately and combined. A convenient form to record this process is:

$$\begin{array}{r} 30 + 6 \\ +\ 20 + 1 \\ \hline 50 + 7 \end{array} \qquad \text{or} \qquad \begin{array}{r} 36 \\ +\ 21 \\ \hline 57 \end{array}$$

When the expanded form of a number is subtracted, use parentheses around the number to show that both parts are being subtracted. For example, for $36 - 21$, one can write:

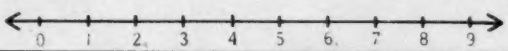
$$\begin{array}{r} 30 + 6 \\ -\ (20 + 1) \\ \hline \end{array}$$

D. Worksheets 86 and 87 can now be done.

Worksheet 86
Unit 13 Name _____

Find the sums and differences. Use the number line if you need it.

30 + 5 + 10 + 2 40 + 7	35 + 12 47	60 + 7 + 20 + 1 80 + 8	67 + 21 88
80 + 7 - (20 + 2) 60 + 5	87 - 22 65	50 + 5 + 40 + 2 90 + 7	55 + 42 97
60 + 3 - (40 + 1) 20 + 2	63 - 41 22	50 + 2 + 30 + 0 80 + 2	52 + 30 82
70 + 1 + 10 + 3 80 + 4	71 + 13 84	60 + 1 - (20 + 1) 40 + 0	61 - 21 40



Worksheet 87
Unit 13 Name _____ _____

Do you remember Jomo and Tanana? On their trip in Africa they counted the storks they saw.

The first week Jomo saw 23 storks.
The second week Jomo saw 22 storks.
In the two weeks he saw [45] storks.

The first week Tanana saw 20 storks.
The second week Tanana saw 14 storks.
In the two weeks she saw [34] storks.

How many more storks did Jomo see? [11]